TM 11-2650

WAR DEPARTMENT TECHNICAL MANUAL

MODULATORS

(WILCOX ELECTRIC TYPES 50A AND 50A3)

WAR DEPARTMENT 19 NOVEMBER 1945

TECHNICAL MANUAL

MODULATOR MD-69/FRT

CHANGES No. 1

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *18 October 1951*

TM 11-2650, 19 November 1945, is changed as follows:

Title is changed to read: Modulator MD-69/FRT.

32. Relays

(Superseded)

a. The proper operation of the relays in the auxiliary relay unit (Wilcox Electric Type 169D) and the dialing unit (Wilcox Electric Type 168C) is essential for trouble-free operation of Modulator MD-69/FRT (Wilcox Electric 50A and 50A3), when dialing from a Remote Control Console CY-161/FRC (Wilcox Electric CS212) or from a local position. Unsatisfactory mechanical and/or electrical condition of the relays (primarily control relay S2 in dialing unit 168C) may result in severe damage to Modulator 50A-10 which is part of Modulator MD-69/FRT.

b. Dialing unit type 168C provides relay and switching circuits for remotely and locally controlling 10 radio transmitters for phone operation. A dial tone from Remote Control Console CY-161/FRC or from the local modulator channel-selector dial (S5) is rectified by rectifier D1. The number of pulses is determined by the number dialed. If number 3 is dialed, there is a long 60-cycle pulse in the order of 35-40 volts while the dial is rotated clockwise to the stop. As the dial is released and it returns to its normal position, there are two additional pulses. The number of pulses, including the initial long pulse, is equal to the number dialed. The rectified direct current from each pulse causes impulse relay S1 to close once for each pulse. During the first long pulse, current flows through the operating coil of control relay S2 which is a slow release relay. The contacts remain closed during the entire dialing operation. They open approximately one-tenth of a second after the last dialing pulse of a sequence is received. Figure 33 shows that the 500-ohm line, between transformer T1 of auxiliary relay unit type 169D and transformer T1 of dialing unit type 168C, is directly grounded on one side. It is grounded on the other side through the center set of contacts when control relay S2 is closed during the dialing operation.

c. Therefore, if the center set of relay contacts on relay S2 fails to close for any reason after impulse relay S1 operates, the 60-cycle dialing pulse in the order of 35-40 volts (the normal speech signal is 1.5 volts) will be impressed upon the grid of vacuum tube V1 in modulator 50A-10 and cause severe damage. The auxiliary control relay unit chassis centralizes the bias control, bias protection, and modulator overload relay circuits. Dialing transformer T2, and isolation transformer T1 are located on the auxiliary control relay unit chassis. Figure 35 is a partial schematic diagram of the bias control, bias protection, and modulator overload circuits.

32.1 Preventive Maintenance Instructions

(Added) (Figs. 11, 12, 13, 14, 16, 17, 33, 35, 38, 39, and 40).

a. The preventive maintenance instructions for the relays in dialing unit 168C and auxiliary control relay unit 169D, outlined below, must be applied at regular weekly intervals. The instructions are essential for trouble-free operation of the communications equipment covered by this technical bulletin.

b. Remove all power from the equipment.

c. Short circuit the h-v terminals with a shorting stick.

d. Disconnect cables and remove the equipment from the cabinet as per instructions in TM 11-2650.

e. Inspect the relays for corrosion, grease, dirt, and broken and/or charred insulation.

f. Inspect the contact points for dirt, pitting, burned spots, tightness of screws, and alinement of relay contact arms and contacts.

g. Use a soft brush to remove corrosion, grease, and dirt.

h. In cases of excessive pitting, corrosion, misalinement of contact arms and contacts, and charred or broken insulation, replace the relay.

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If the contact arms are not severely misalined, use a contact spring bending tool to realine the contact arms. If the contacts are not severely pitted, clean them by polishing with a relay burnishing tool. Be extremely careful to keep the contact surfaces parallel and be careful not to spring the contact arms.

i. Use a soft brush to remove particles of dust from control relay S2 (dialing unit 168C). Use a relay burnishing tool to polish contacts and use a contact spring bending tool to adjust the center set of contacts, which connect transformer T1 to ground, so that they close slightly before any other contacts when in the energized position.

j. Upon completion of the preventive maintenances outlined above, check the over-all performance of the equipment in accordance with paragraph 21.

Note. For more detailed information on relays, refer to paragraphs 111, 113, 114, 115, 121, and 122 in TB SIG 178.

[AG 300.7 (27 Sep 51)]

BY ORDER OF THE SECRETARY OF THE ARMY:

J. LAWTON COLLINS
Chief of Staff, United States Army

OFFICIAL:
WM. E. BERGIN
Major General, USA
The Adjutant General

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WAR DEPARTMENT TECHNICAL MANUAL
TM 11-2650

MODULATORS
(WILCOX ELECTRIC TYPES 50A AND 50A3)

WAR DEPARTMENT *19 NOVEMBER 1945*

WAR DEPARTMENT
WASHINGTON 25, D. C., 19 Nov 1945

TM 11-2650, Modulators (Wilcox Electric Types 50A and 50A3), is published for the information and guidance of all concerned.

[AG 300.7 (28 Sep 44)]

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Refer to FM 21-6 for explanation of distribution formula.

WARNING

HIGH VOLTAGE

is used in the operation of
this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

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TABLE OF CONTENTS

PART FIVE. Repair Instructions.

APPENDIX.

LIST OF ILLUSTRATIONS

DESTRUCTION NOTICE

WHY — To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN— When ordered by your commander.

HOW — 1. Smash — Use sledges, axes, handaxes, pickaxes, hammers, crowbars, heavy tools.

2. Cut — Use axes, handaxes, machetes.

3. Burn — Use gasoline, kerosene, oil, flame throwers, incendiary grenades.

4. Explosives — Use firearms, grenades, TNT.

5. Disposal — Bury in slit trenches, fox holes, other holes. Throw in streams. Scatter.

USE ANYTHING IMMEDIATELY AVAILABLE FOR DESTRUCTION OF THIS EQUIPMENT

WHAT— 1. Smash — Chassis, panel, transformers, chokes, capacitors, resistors, terminal boards, sockets, coils, tubes, controls.

2. Cut — All wiring or cables.

3. Burn — This technical manual.

4. Bend — Control brackets and shafts

5. Bury or scatter — Any or all of above pieces after breaking.

DESTROY EVERYTHING

SAFETY NOTICE

Voltages as high as 4,000 volts are used in the operation of this equipment. These voltages are dangerous to life.

All doors and panels leading to compartments containing high-voltage terminals are provided with interlock switches which remove the high voltage from ALL the station equipment when these doors are opened or panels removed. Bleeders are provided on all high-voltage capacitors in the modulator which discharge the capacitors when the high voltage is removed. However, as an added safety precaution, ground each high-voltage capacitor with a grounding stick, open the 220-volt a-c supply switch, and remove the main fuses before servicing the modulator.

First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4

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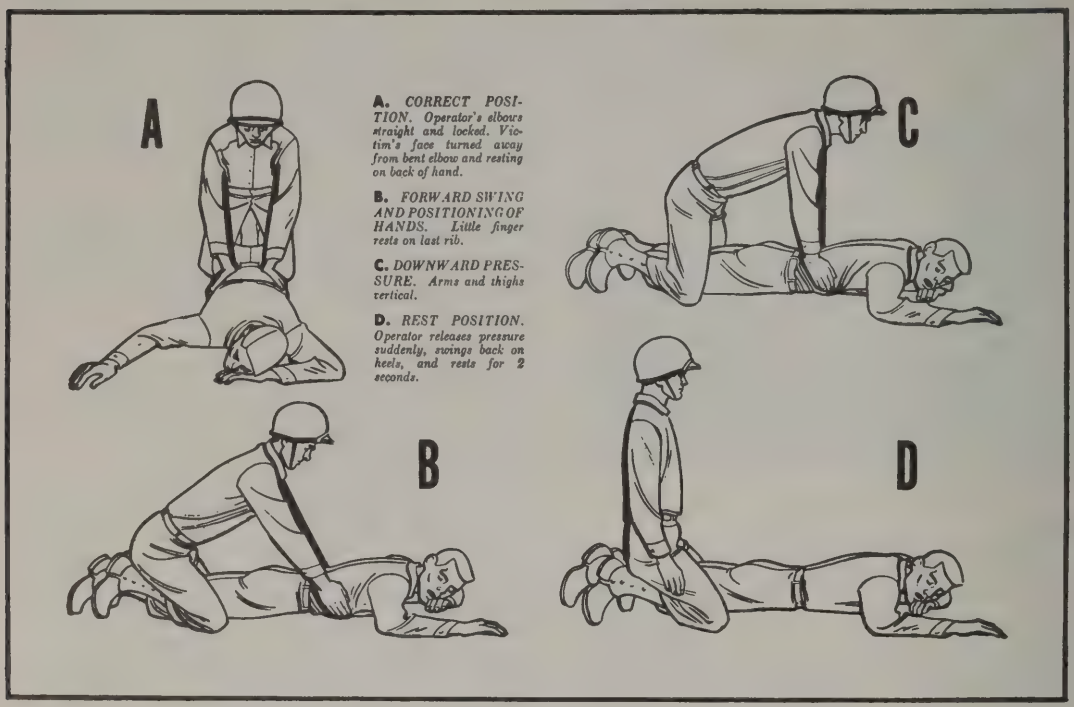

A. *CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.*

B. *FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.*

C. *DOWNWARD PRESSURE. Arms and thighs vertical.*

D. *REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.*

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand, one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

XIV

Figure 1. Modulator (Wilcox Electric type 50A3) and associated equipment.

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PART ONE
INTRODUCTION

SECTION I. DESCRIPTION

1. GENERAL.

a. Modulator (Wilcox Electric type 50A3) is a single unit enclosed in a steel cabinet. The modulator cabinet contains modulator (Wilcox Electric type 50A-10), an amplifier capable of 100 percent modulation of one 2,000- to 2,400-watt radio transmitter. In addition, the cabinet contains a dialing unit and auxiliary control relay unit for use with remote control equipment, and a separate filter choke and modulation transformer. The dialing unit and control relay unit are provided for switching the modulator to any one of a number of transmitters under control of equipment located at a remote point. The equipment is intended primarily for point-to-point and ground-to-air communications.

b. Modulator (Wilcox Electric type 50A) is identical with modulator type 50A3 except for the arrangement of the main terminal board. Throughout this manual references to modulator type 50A3 also apply to modulator type 50A unless otherwise specified.

2. APPLICATION OF EQUIPMENT.

Figure 2 is a block diagram of a typical installation of modulator type 50A3 and its associated transmitters, rectifiers, and remote control equipment. An installation usually includes a number of high-frequency transmitters (Wilcox Electric type 96C3) and may include some low-frequency transmitters (Wilcox Electric type 96-200C). Power is supplied to the modulator and the transmitters from rectifier (Wilcox Electric type 36A4). The transmitting equipment is controlled by Remote Control Console CY-161/FRC. For a large installation, six consoles or operating positions may be connected in parallel. The remote control consoles have facilities for the selection and control of as many as nine transmitters. Four modulators may be installed and controlled, if required, to handle the necessary traffic messages.

3. TECHNICAL CHARACTERISTICS.

Power input:

Modulator plate supply	4,000 v, 0.4 amp
A-c power supply	220 v, 15 amp
Relay system	12 v d-c
Audio input	0 to 3 db (0.006 watt)
Audio output	1,600 watts
Number of tubes	15
Frequency range	400-3,000 cps
Weight	963 lb

4. TABLE OF COMPONENTS.

COMPONENT	QUANTITY	HEIGHT (in.)	DEPTH (in.)	LENGTH (in.)	WEIGHT (lb)	VOLUME (cu ft)
Modulator type 50A3	1	72	24½	29½	963.0	31.0
Modulator type 50A3 Cabinet less major components, filter choke, and modulation transformer	1	72	24½	29½	480.0	31.0
Modulator type 50A-10	1	8⅞	21	23	97.5	2.5
Dialing unit type 168C	1	11¼	3½	19	10.25	.43
Auxiliary Control relay unit type 169D	1	8¾	3½	19	10.0	.34
Filter choke L1	1	8¾	10¼	18¼	183.0	.95
Modulation transformer T2	1	9¼	10½	20¾	178.0	1.16
Operating tubes	15	....	....	....	3.9	....
TM-11-2650	2	....	....	....	1.25	....
Spare tubes	1 set	....	....	....	3.9	....
Spare parts	1 set	....	....	....	....	....

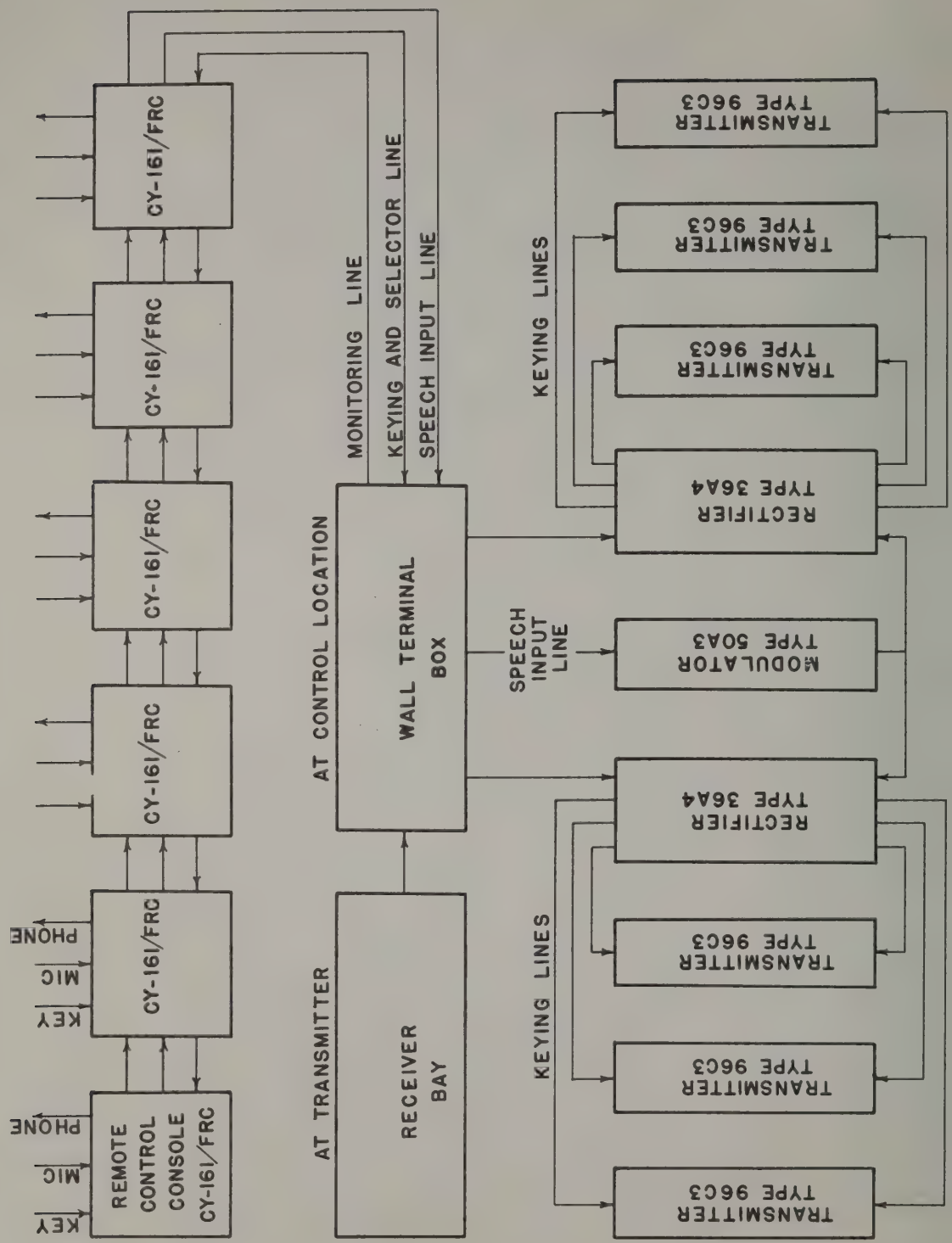


Figure 2. Modulator type 50A3 and associated equipment, block diagram.

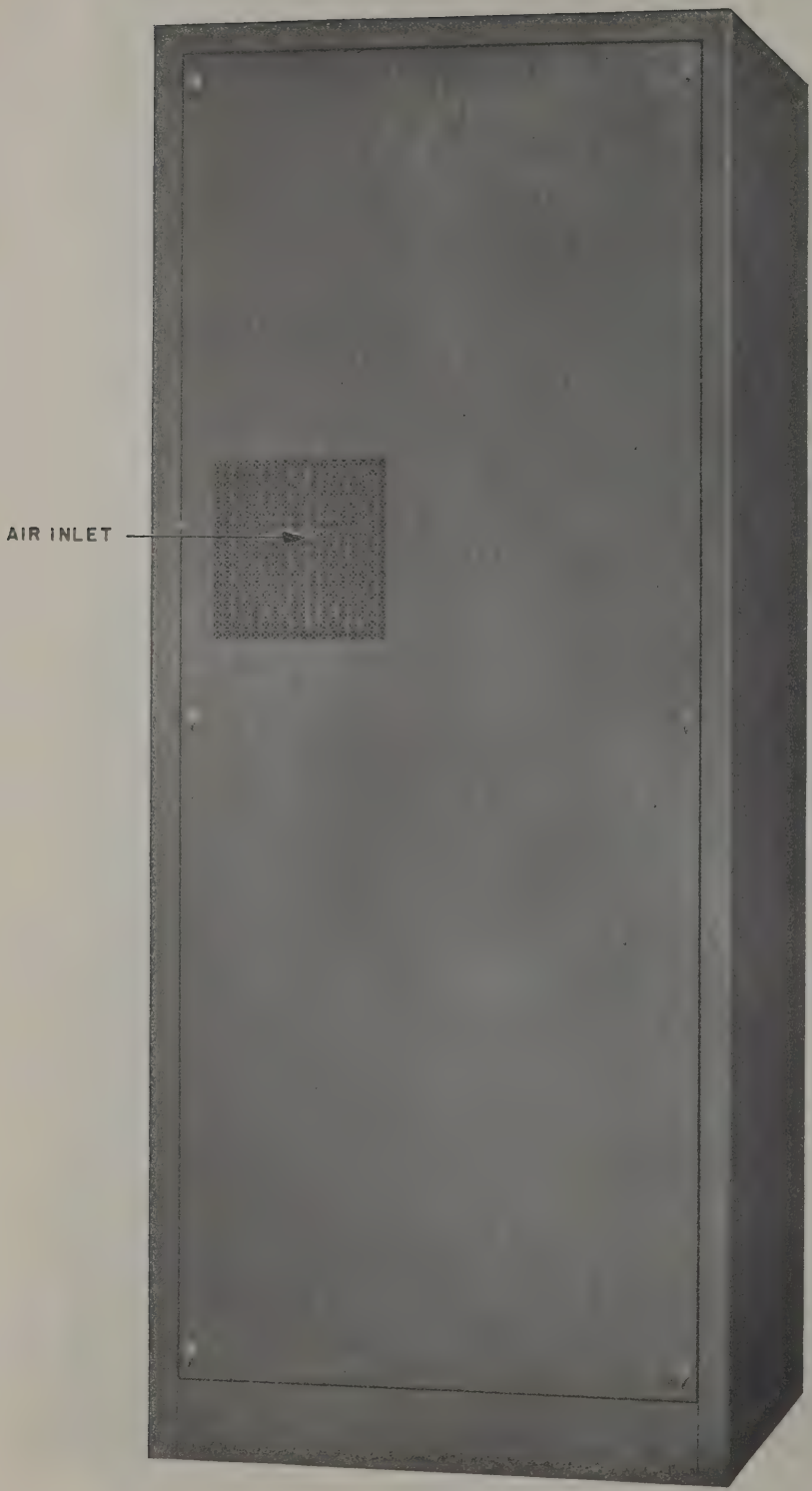
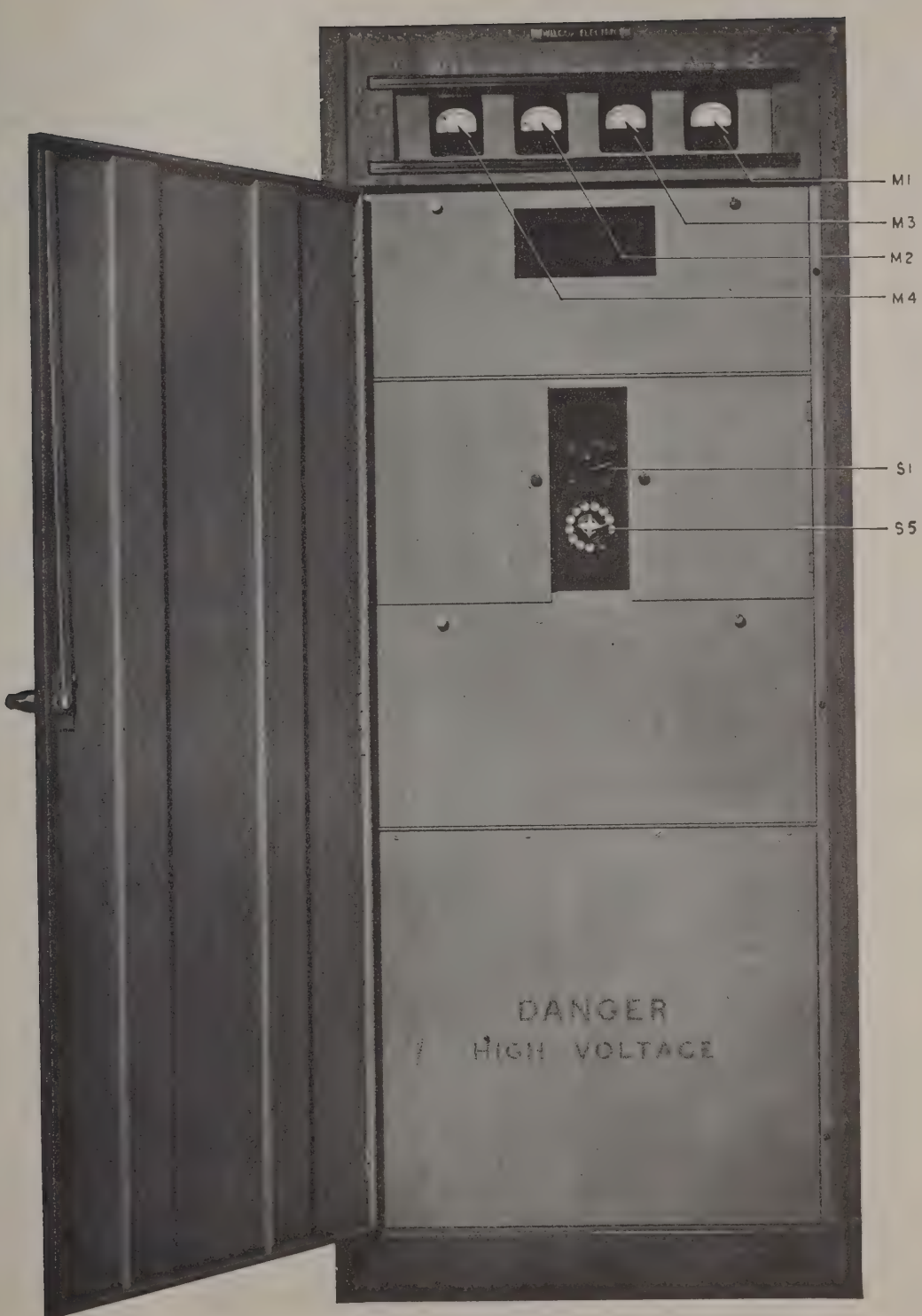


Figure 4. Modulator type 50A3, rear view.



TL 14553S *Figure 5. Modulator type 50A3, front door open showing control and safety panels.*

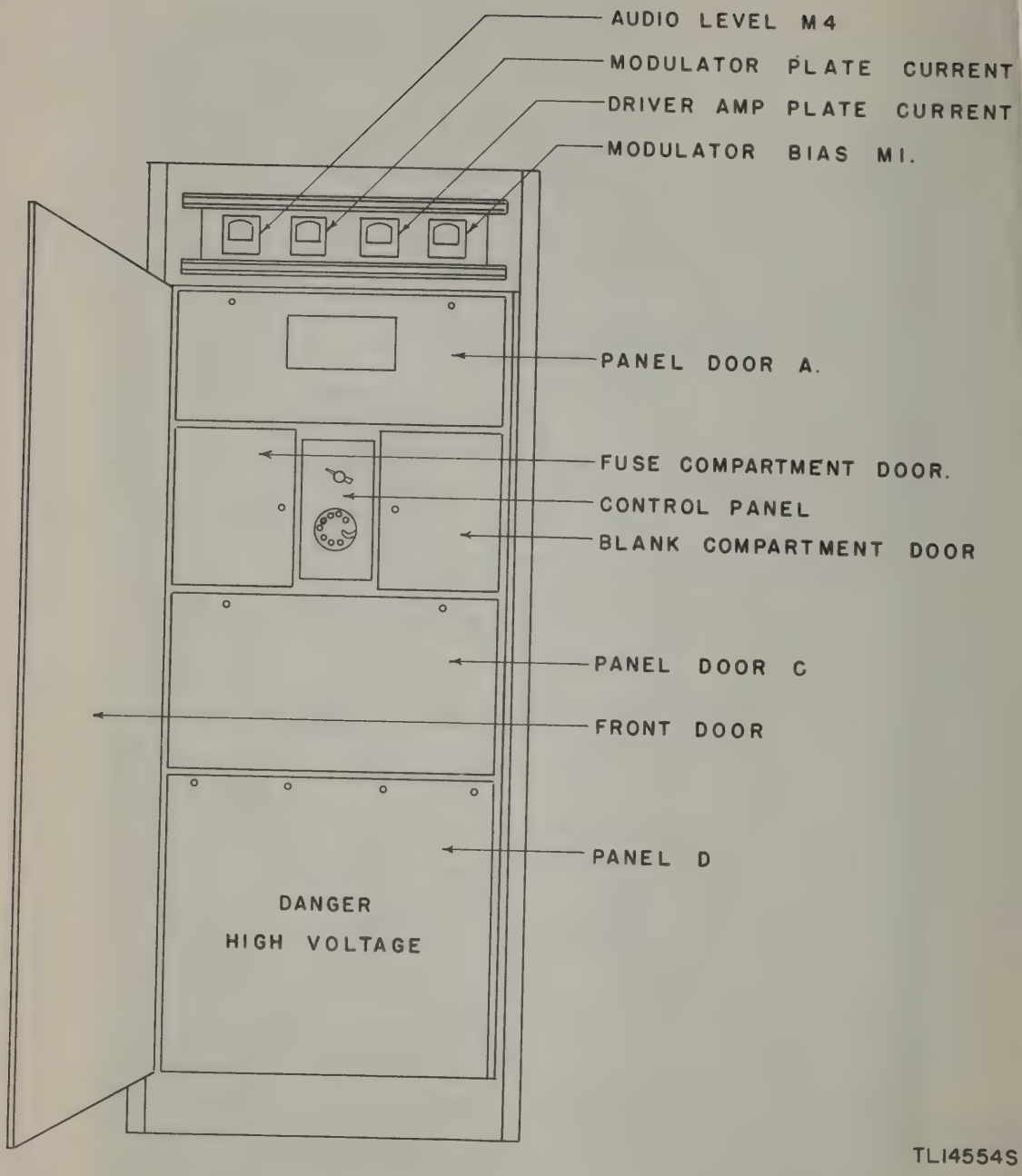


Figure 6. Modulator type 50A3, front panel designations.

. PACKAGING DATA.

Modulator type 50A3 is packed in 10 sealed ooden boxes of weights and dimensions given n the following table.

NOTE: Items may be packaged in a different manner from that shown, depending upon supply channels.

NO. OF PKGS.	HEIGHT (in.)	DEPTH (in.)	LENGTH (in.)	WEIGHT (lb)	VOLUME (cu ft)
1	33¾	44¾	87¼	912.0	77.8
1	17⅝	35⅝	36⅞	219.0	13.7
1	10	16⅛	23¼	39.0	2.16
1	10	16⅛	23¼	40.0	2.16
1	17	17⅜	29⅝	255	5.05
1	17	17⅜	29⅝	245	5.05
1	28¼	12¼	23¼	53.0	4.66
1	28¼	12¼	23¼	52.0	4.66
1	28¼	12¼	23¼	52.0	4.66
1	7½	17	28½	55.0	2.10

3. DESCRIPTION OF MAJOR COMPONENTS.

a. Modulator Cabinet. The modulator equipment is installed in a metal cabinet with integral shelves. Both the front and rear of the cabinet are equipped with doors or removable panels for complete and convenient access to all equipment. Figure 3 illustrates the front of the cabinet with the door closed as in normal operation. Figure 4 is a rear view of the cabinet showing the cabinet-size removable panel. An air filter is attached to the panel just inside the air-inlet grill. The panel is attached with the six thumbscrews.

b. Front Panels. Figure 5 is a front view of modulator type 50A3 with the door open showing the control and safety panels. The tubes may be observed through the window in the top panel. The nameplate on the interior of the door gives the type and serial number of the modulator. Serial numbers 1 to 659 are designated 50A on the nameplate. Serial number 660 and those succeeding are designated 50A3. Figure 6 gives the front panel designations of the modulators.

c. Instrument Panel.

(*1*) AUDIO LEVEL meter M4 indicates the level of the audio input signal, and the relative output level of the driver amplifier in decibels (db).

(*2*) MODULATOR meter M2 indicates the total cathode current of the modulator power amplifier.

(*3*) DRIVER AMP meter M3 indicates the balance of cathode current in the two sides of the parallel push-pull driver amplifier. The meter can be switched to either cathode circuit at will to compare these currents.

(*4*) MODULATOR BIAS meter M1 indicates the bias on the modulator power-amplifier tubes.

d. Control and Fuse Panels. The control panel is located just below the window (fig. 5). Figure 7 also shows the fuse panel just to the left of the control panel. Details of both the fuse and control panels are given in figure 8. The switch in the upper half of the control panel is for instrument selection, and the MODULATOR CHANNEL SELECTOR dial is for local testing of the channel selection equipment. The fuse panel contains the blower motor and the modulator power-amplifier filament fuses.

e. Safety Panels. Figures 5 and 7 illustrate the safety panels closed and open. All doors to compartments containing high-voltage terminals are equipped with interlock switches. The large lower panel marked DANGER HIGH VOLTAGE is not equipped with an interlock, but several screws must be removed to open it. Thus, it will not be opened by mistake.

f. Modulator Type 50A-10. The modulator type 50A-10 chassis occupies the entire space of shelf A in modulator type 50A3, as shown in figures 7 and 9. Figure 10 is a top view of the modulator. The modulator unit is a complete four-stage audio amplifier, including all power supplies except the 4,000-volt plate supply for the modulator power amplifier. The unit receives the microphone signals from the remote control console at 0 to 3 db, and amplifies them sufficiently to supply modulated plate voltage to the final stage of a 2,000- to 2,400-watt transmitter.

g. Blower. The blower is mounted just below the modulator chassis on shelf B (fig. 9). It draws air through the air-inlet grill and filter in the back panel and forces it past the modulator tubes through the ventilation holes in the chassis (fig. 10). The air is exhausted through a grill in the top of the cabinet.

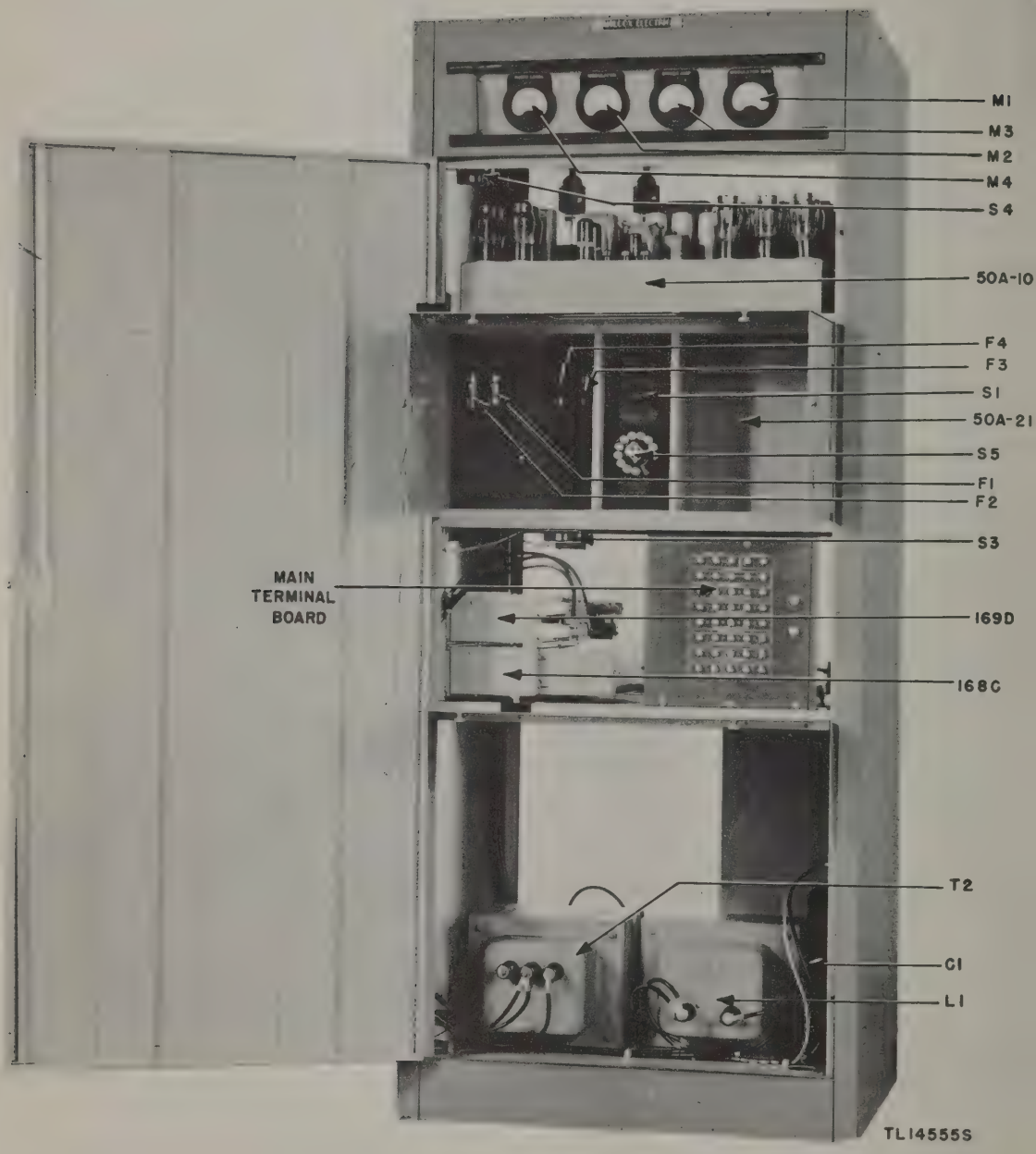


Figure 7. Modulator type 50A3, front view, safety panels open.

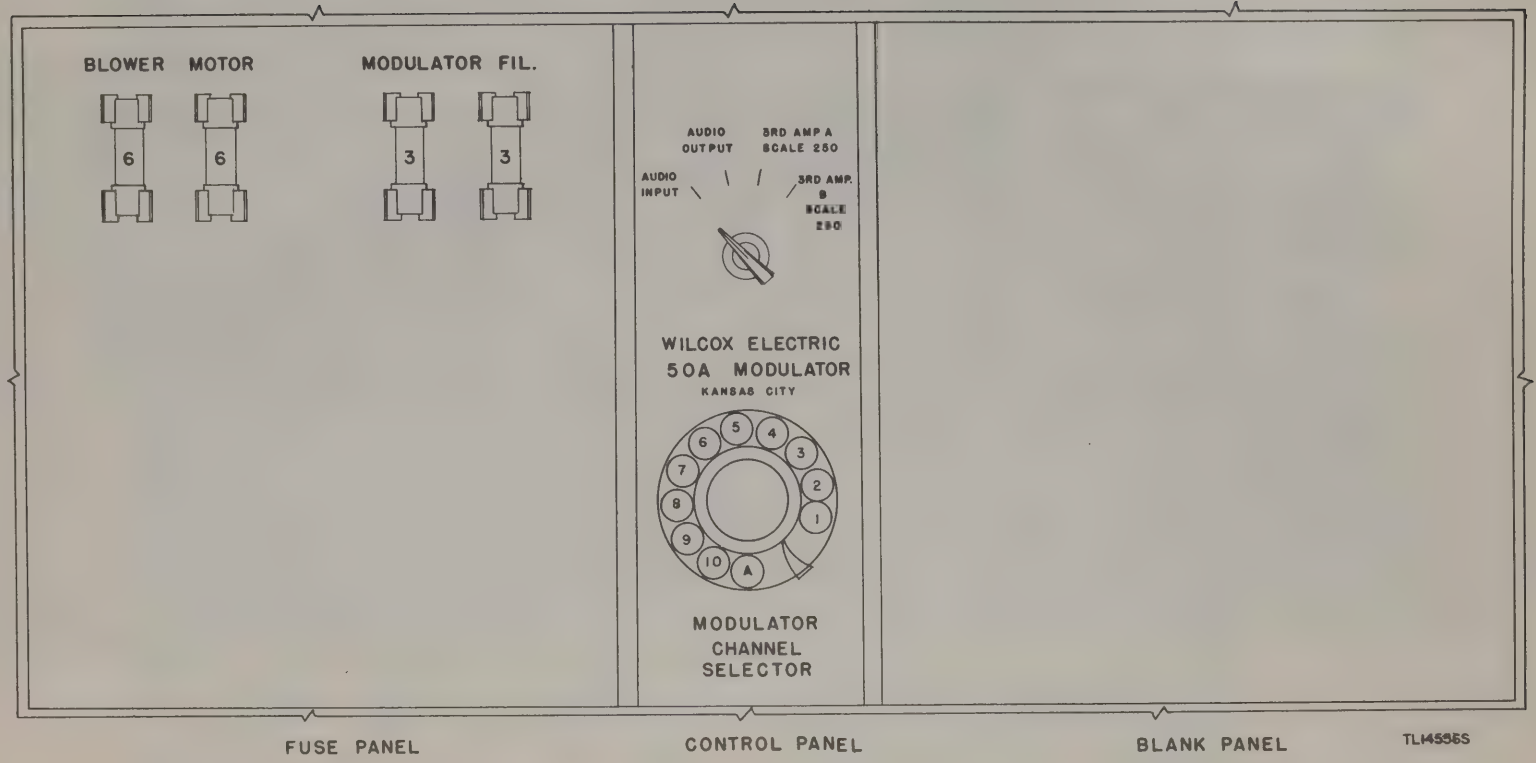


Figure 8.-Modulator type 50A3, fuse and control panel details.

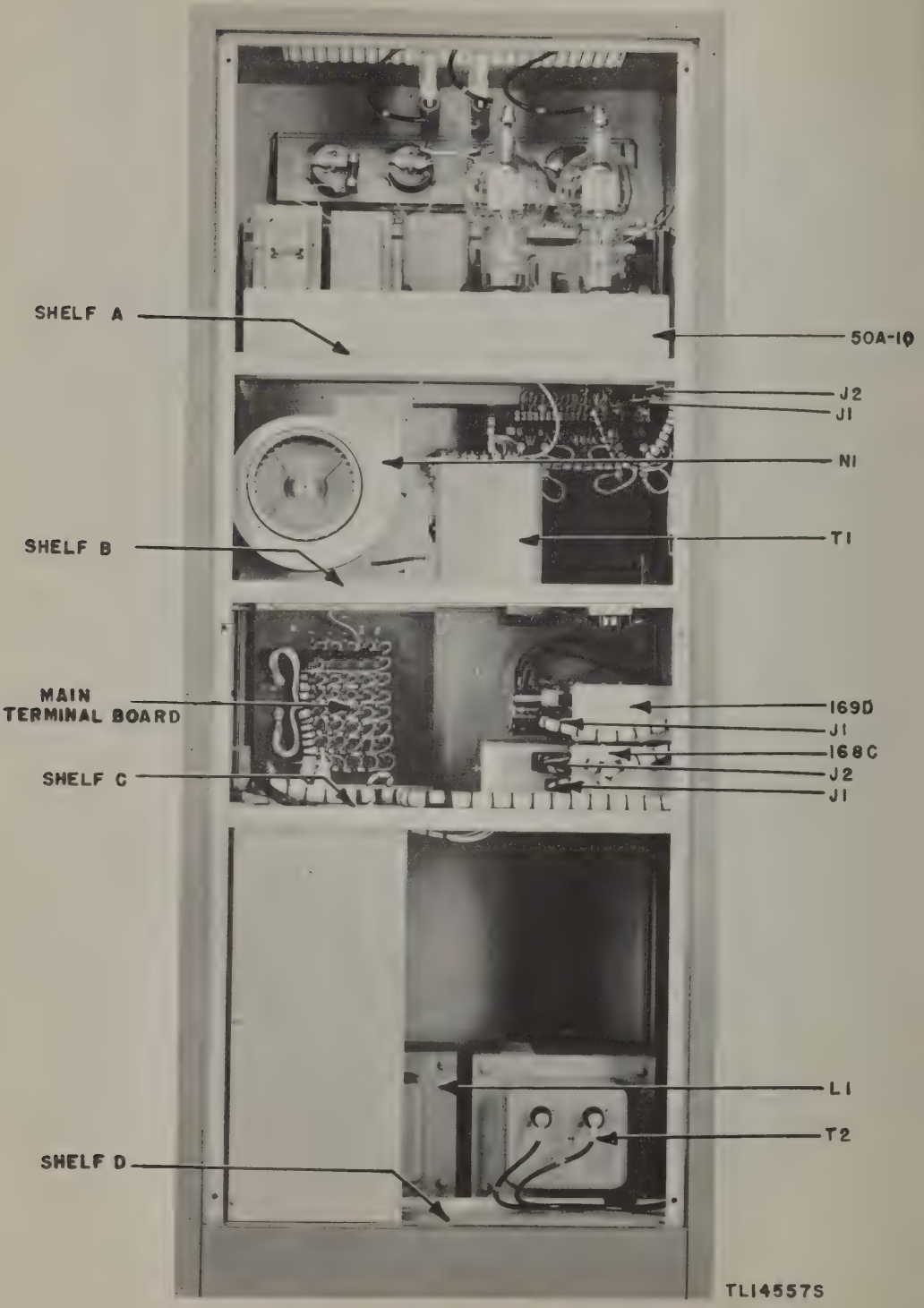


Figure 9. Modulator type 50A3, rear interior view.

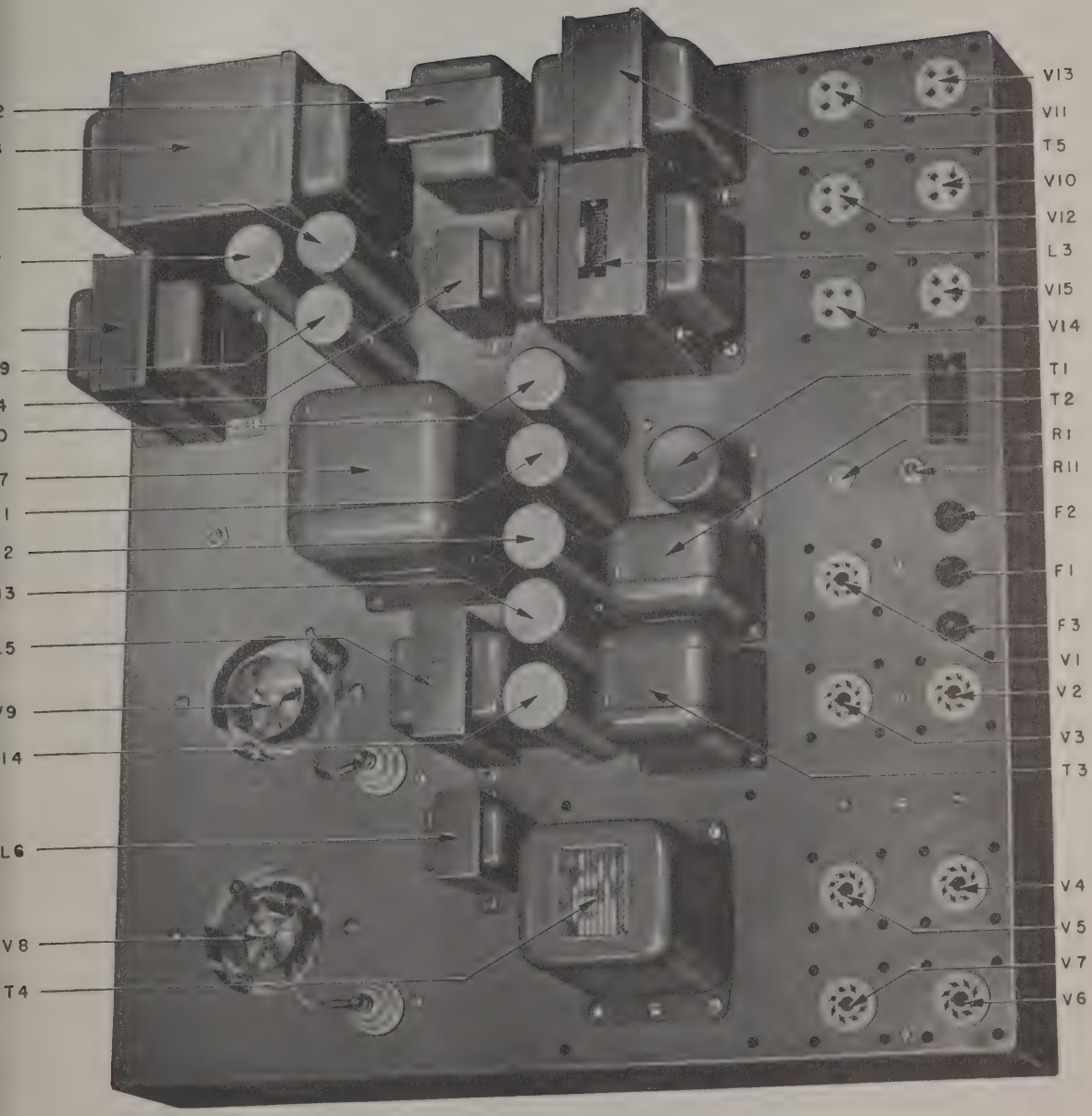


Figure 10. Modulator unit type 50A-10, top view.

Figure 11. Auxiliary control relay unit type 169D, front view

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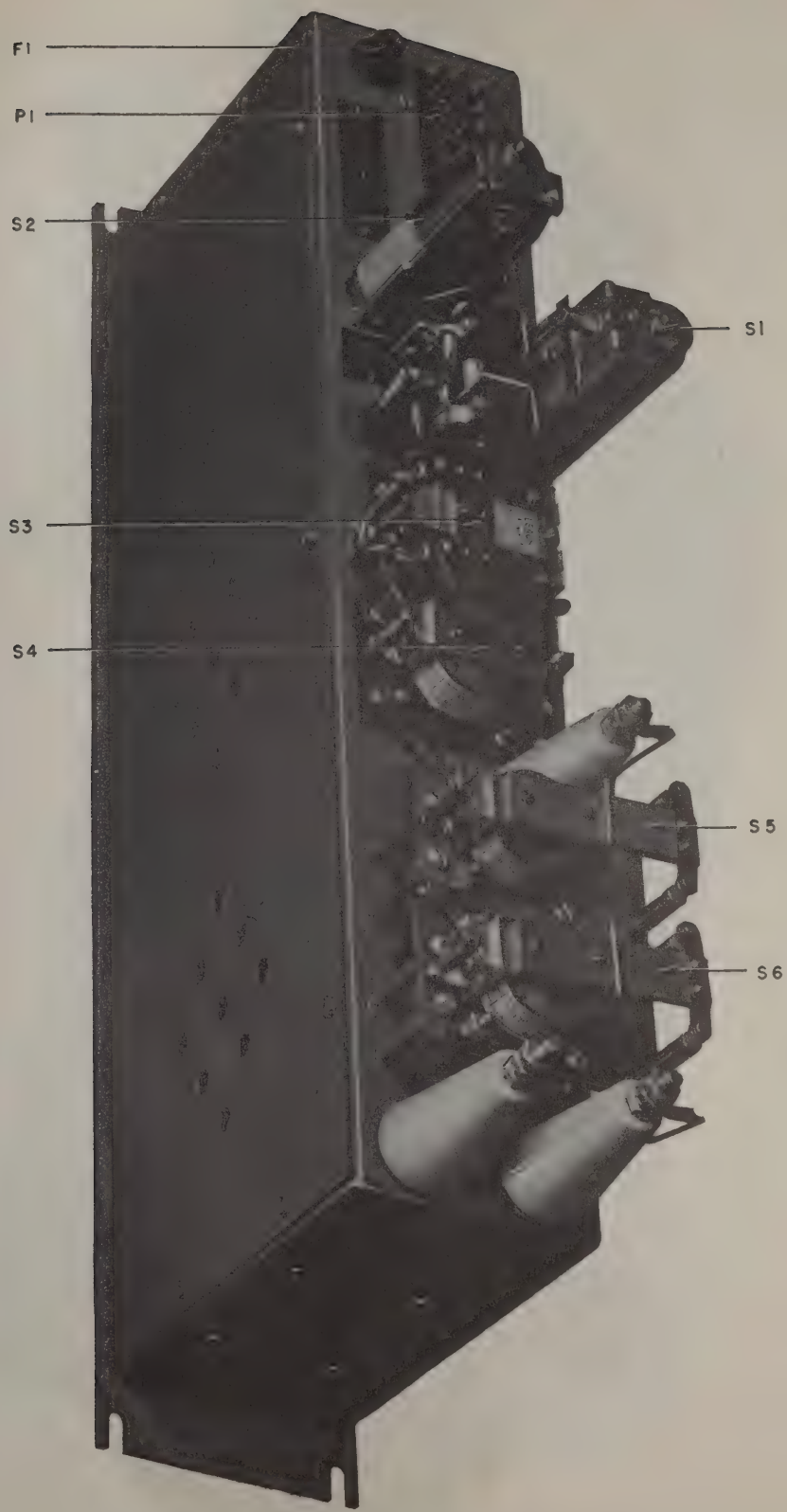

Figure 12. Auxiliary control relay unit type 169D, rear view.

Figure 13. Dialing unit type 168C, front view.

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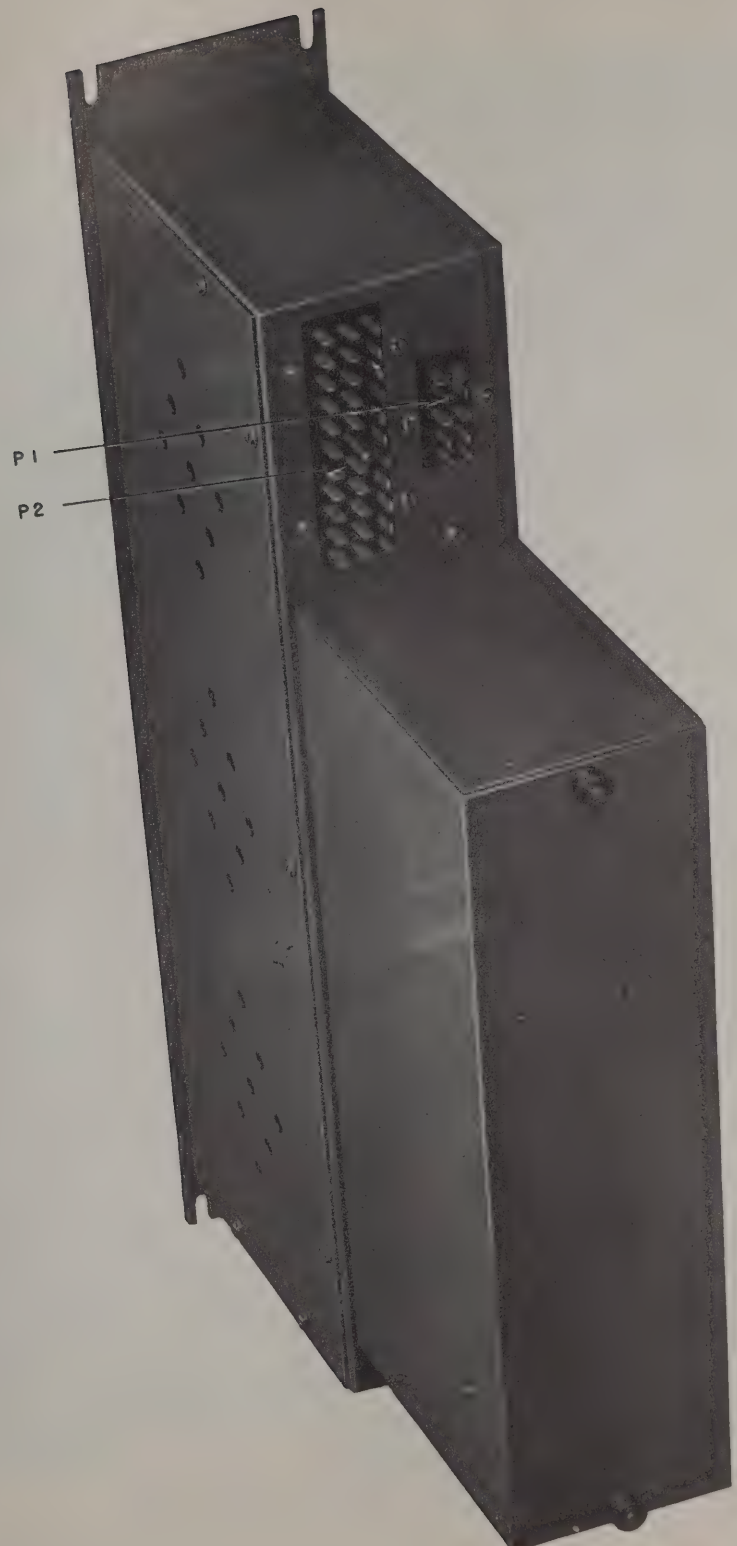

Figure 14. Dialing unit type 168C, rear view.

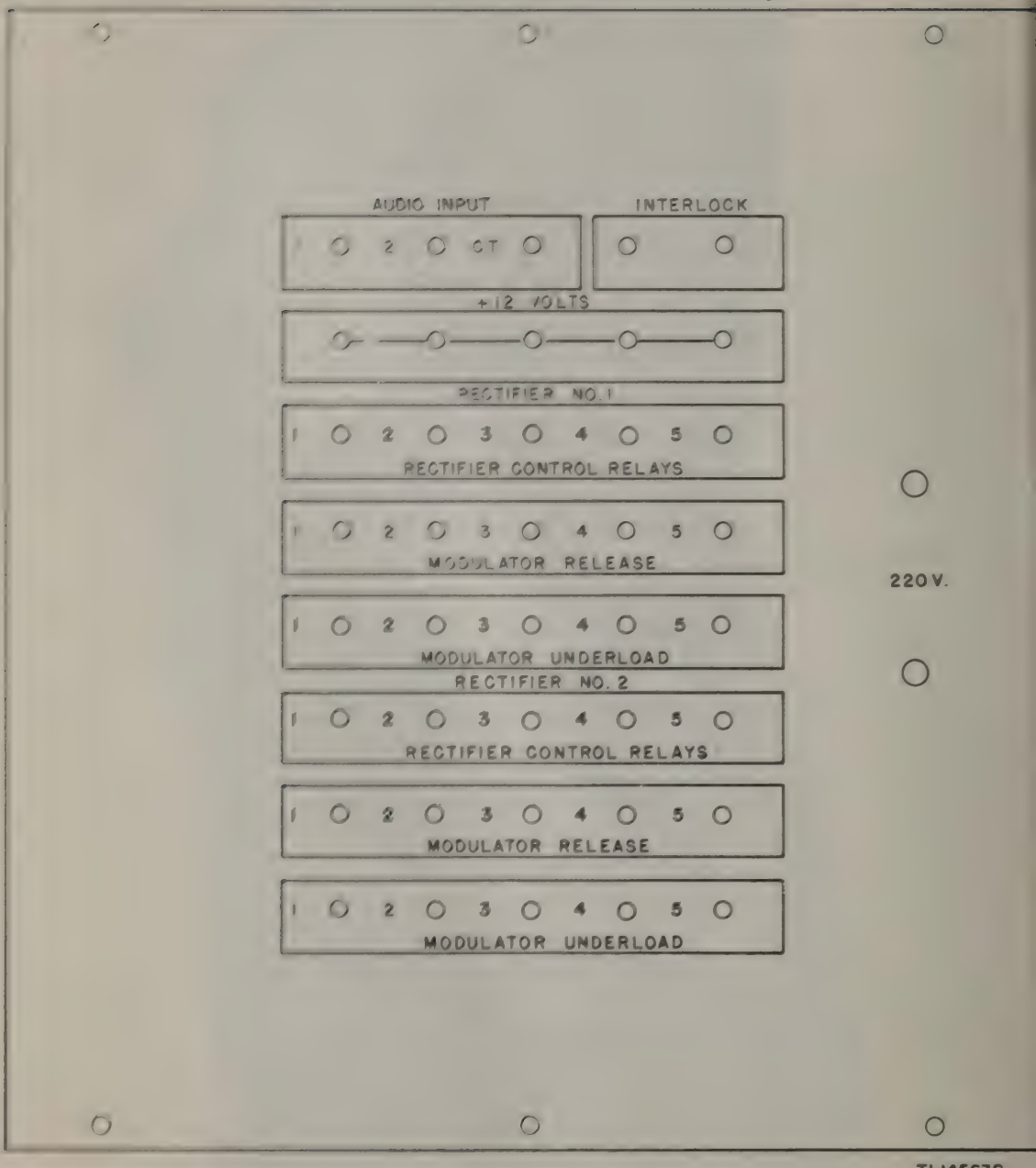

Figure 15. Modulator type 50A3, main terminal board.

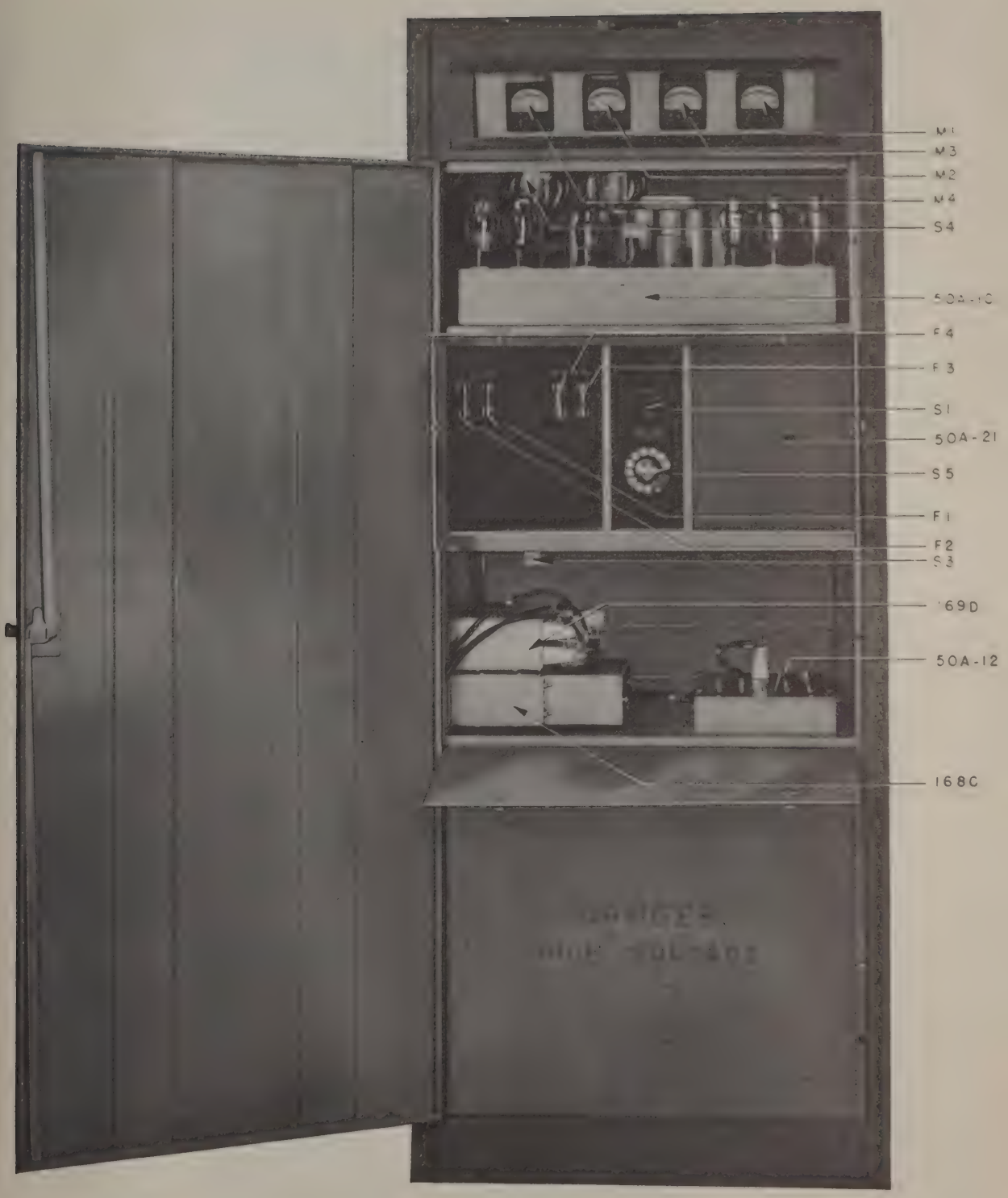

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Figure 16. Modulator type 50A, front view, safety panels open.

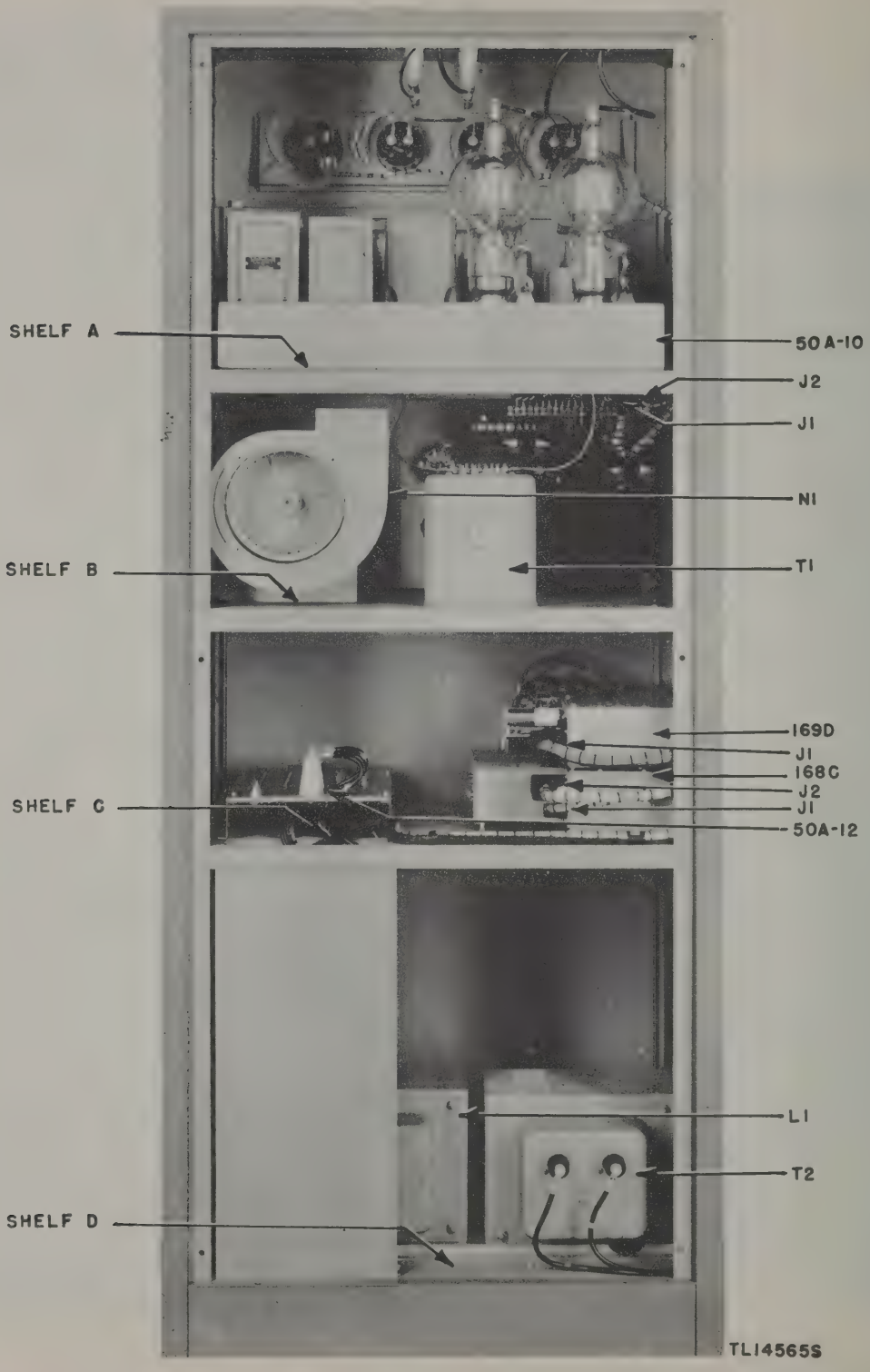


Figure 17. Modulator type 50A, rear interior view.

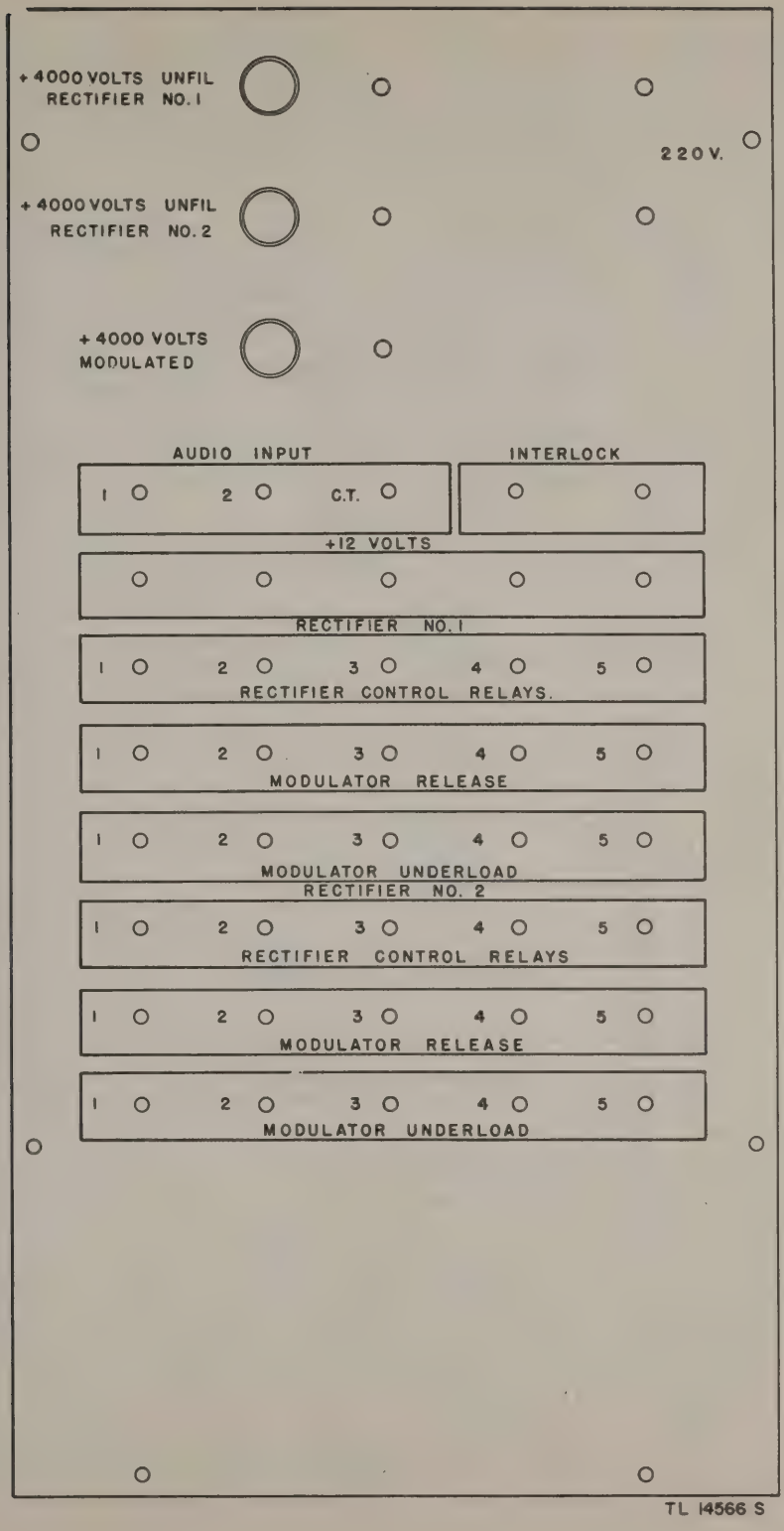


Figure 18. Modulator type 50A, main terminal board.

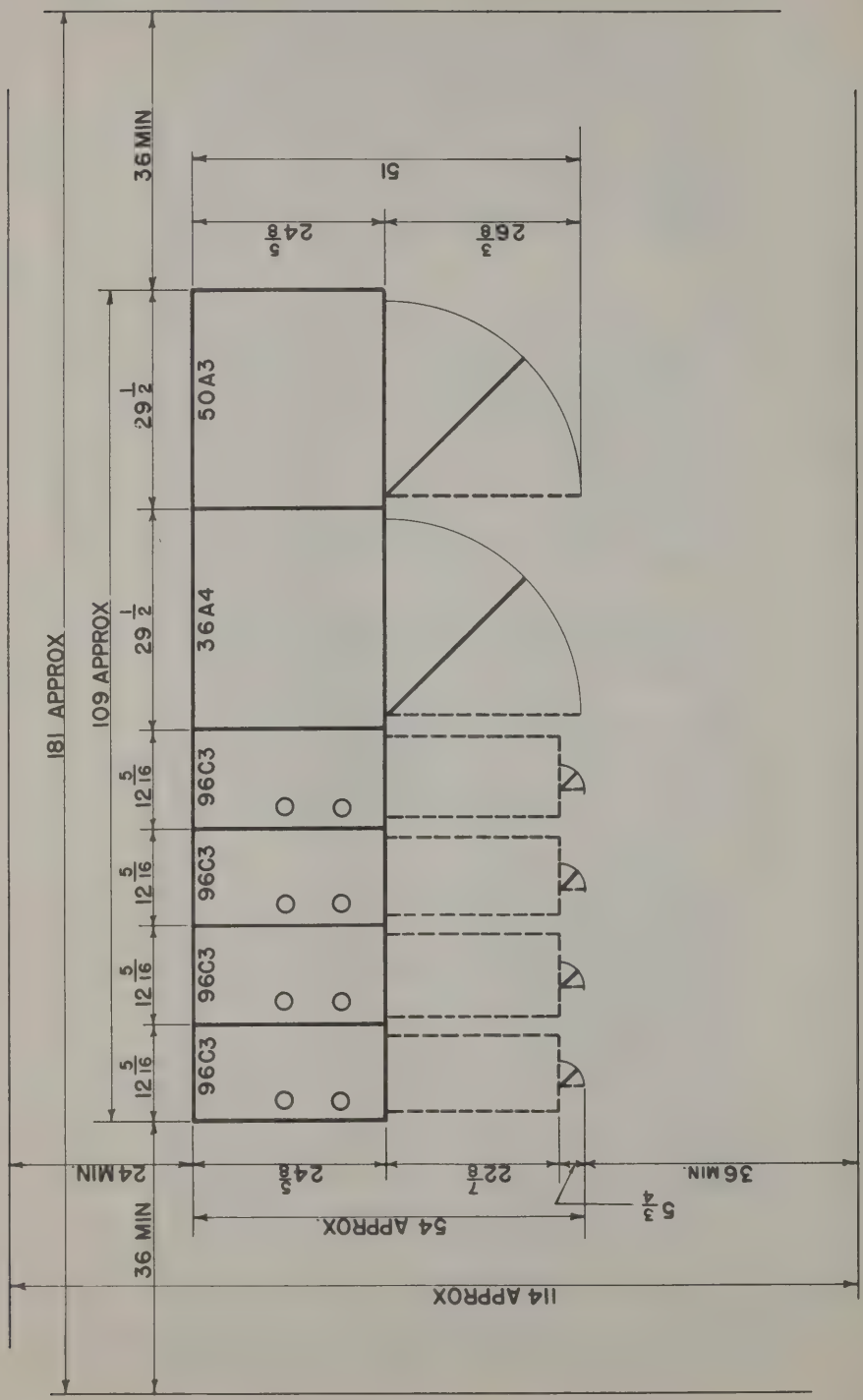


Figure 19. Modulator type 50A3 and associated equipment, installation dimensions

h. Auxiliary Control Relay Unit (Wilcox Electric Type 169D). The auxiliary control relay unit (figs. 7, 11, and 12) contains two high-voltage relays for connecting the 4,000-volt supply from either of two rectifiers to the modulator power amplifier. It also contains the modulator overload and bias protection relays.

i. Dialing Unit (Wilcox Electric Type 168C). The dialing unit (figs. 7, 13, and 14) contains the minor switch and a group of rectifier selector relays. The minor switch is a multiple-contact switch which is actuated by the pulses from the telephone dial at the remote control console. This switch controls the connection of the modulated plate voltage to the desired transmitter.

j. Main Terminal Board. Figure 7 illustrates the location of the main terminal board in the cabinet. The terminal board details are shown in figure 15. All interconnections between the modulator and its associated equipment are made to this terminal board with the exception of the 4,000-volt power supply connections from the rectifiers, which are made to the stand-off insulators located in back of the terminal board.

k. Modulator Power-amplifier Autotransformer and Choke. These two components are located on shelf D as shown in figure 9.

l. Interlock System. The modulator interlock system consists of three switches which are actuated by the safety panels and doors. The switches are S3 and S4 of figure 7 and switch S2 of figure 9. The 4,000-volt supply from the rectifier is shut off instantly if any of these doors or panels are opened while the equipment is in operation.

7. DIFFERENCES IN MODELS.

Modulator type 50A is identical with modulator type 50A3 except for the arrangement of the main terminal board. The position of the terminal board in modulator type 50A is illustrated in figures 16 and 17. Figure 18 is a diagram of the terminal board. All connections between modulator type 50A and its associated transmitter equipment are made to this terminal board.

SECTION II. INSTALLATION

8. SITING.

a. Location of Transmitter Station. The location of modulator type 50A3 and its associated transmitters and rectifiers will be determined by the ground and antenna requirements of the radio transmitters, and by the availability of suitable housing.

b. Housing of Transmitter Station Equipment. The transmitter station equipment should be adequatetly housed to protect both the equipment and operators from the weather. Figure 19 gives the installation dimensions for four radio transmitters type 96C3, one modulator type 50A3, and one rectifier type 36A4. The space required for any number of transmitters, modulators, and rectifiers can be readily determined from this drawing. Adequate clearance to the walls must be maintained for servicing the equipment. The weight table below should be used to check the floor loading. The total weight of the installation will be determined by the number of units installed. The floor must be smooth and level to make the cabinets line up accurately.

EQUIPMENT	WEIGHT (lb)
Rectifier type 36A4	1,616
Modulator type 50A3	963
Radio transmitter type 96C3	365

9. UNPACKING AND REMOVAL OF WATERPROOFING.

Use particular care when unpacking or handling the equipment because it may be damaged easily when not protected by the packing case. When unpacking the modulator and associated equipment, follow the steps outlined below.

a. Break the metal bands around the boxes containing the modulator unit, the modulator cabinet, the filter chokes and the modulation transformer. Pull out the lower two rows of nails on the sides and the lowest row of nails on the ends of the crates and lift the crates straight up until they are free from the bottom. Remove the waterproof lining, taking care not to damage the moisture-vapor barrier beneath.

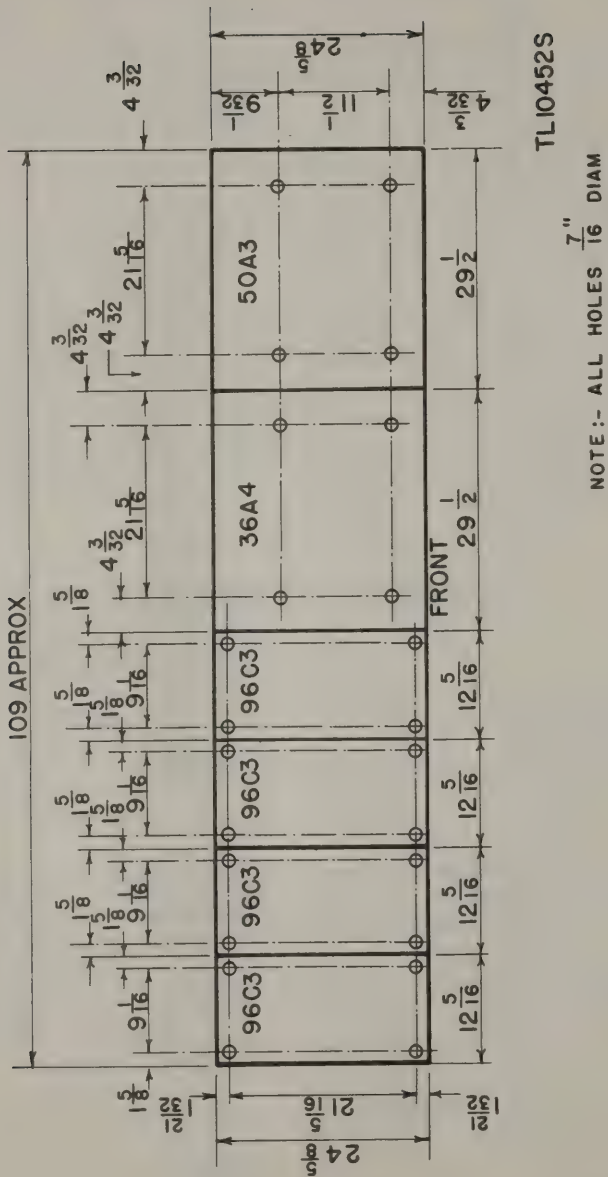


Figure 20. Modulator type 50A3 and associated equipment, mounting dimensions.

Remove the moisture-vapor barrier by cutting away the heat-sealed surfaces along three sides. Roll the barrier back out of the way and remove the steel bands binding the equipment to the pallet.

b. Break the metal bands around the boxes containing the dialing unit and the auxiliary control relay unit and remove the lids. The units are first packed in cartons, then in foil bags, and then in other cartons.

c. Remove the steel bands and eight wood screws from the lids of the three boxes containing the spare and operating tubes. Each tube is contained in a two-piece slide corrugated fibreboard carton and is further contained in a standard tube carton.

d. Remove the strapping and pull the nails from the lid of the box containing the spare parts. Check the contents against the accompanying itemized packing list.

10. MOUNTING THE TRANSMITTER EQUIPMENT CABINETS.

Figure 20 gives the mounting and drilling dimensions for four transmitters, one rectifier and one modulator. These dimensions may be extended to cover any number of units. The bolt holes for wood flooring or expansion bolts for concrete should be drilled before the cabinets are moved into place. In case of steel flooring, the holes should be drilled and tapped for ¼-20 machine screws. The large back panel door and safety panel D should be removed before mounting the cabinet for convenience in locating it over the pre-drilled holes. The bolts are inserted through the four holes in shelf D to attach the cabinet to the floor.

11. INSTALLATION OF COMPONENTS.

To prevent damage during shipment, all plugs and connection leads have been tied securely. Remove all these fastenings before proceeding with the installation of the equipment.

a. Modulator Type 50A-10. Remove the large rear panel and open panel door A. Place the modulator chassis on shelf A with the line of small tubes at the front of the cabinet (fig. 7). Place the chassis over the mounting holes, and secure it with the screws provided.

b. Dialing Unit Type 168C. Mount the dialing unit with four screws to the relay rack mounting strips on the left side of shelf C (fig. 7).

c. Auxiliary Control Relay Unit Type 169D. Mount this unit with four screws just above the dialing unit.

d. Modulation Autotransformer and High-voltage Filter Choke. Place these two units on shelf D against the angle iron stop as shown in figure 9. They are not attached to the modulator.

12. CONNECTIONS BETWEEN CABINET COMPONENTS.

The leads and connecting plugs to the various cabinet components are shown in figure 21.

a. Modulator Type 50A-10. Plug the 18-contact jack found on the right side of shelf B into plug P1 of the modulator chassis (fig. 37). Plug the 3-contact a-c power jack found on the right side of shelf B into plug P2 of the modulator chassis. Connect the two modulator power-amplifier filament leads (fig. 37) to the two outer secondary terminals of transformer T1 (fig. 21).

b. Dialing Unit Type 168C. Plug the 10-contact jack J1 (fig. 9) into plug P1 of the dialing unit. Plug the 33-contact jack J2 into plug P2 of the dialing unit (fig. 14). Note that jack J2 breaks out of the cabinet interwiring below jack J1 which connects to the auxiliary control relay unit.

c. Auxiliary Control Relay Unit Type 169D. Plug the 33-contact jack J1 (fig. 9) into plug P1 of the auxiliary control relay unit (fig. 12). Connect the high-voltage lead marked 4 (fig. 7) to the upper stand-off insulator at the front of the control unit. Connect the high-voltage lead marked 5 to the lower stand-off insulator at the front of the control unit. Leads 4 and 5 were marked A and B respectively in a few modulators. In case difficulty is encountered in identifying these leads, the connection to the upper insulator at the front of auxiliary control unit should be traced to the rear stand-off insulator of shelf C, and the connection to the insulator just below should be traced to the middle stand-off insulator on shelf C. Connect the lead marked 54 to the stand-off insulator back of relays S5 and S6 (fig. 12).

d. Modulator Autotransformer. Connect lead 53 to the left binding post and lead 52 to the right binding post at the back of autotransformer T2 (fig. 9). Connect the two leads 55 to the unmarked binding post at the front of transformer T2. Connect the lead marked 9 to the terminal marked 5000 on the front side of

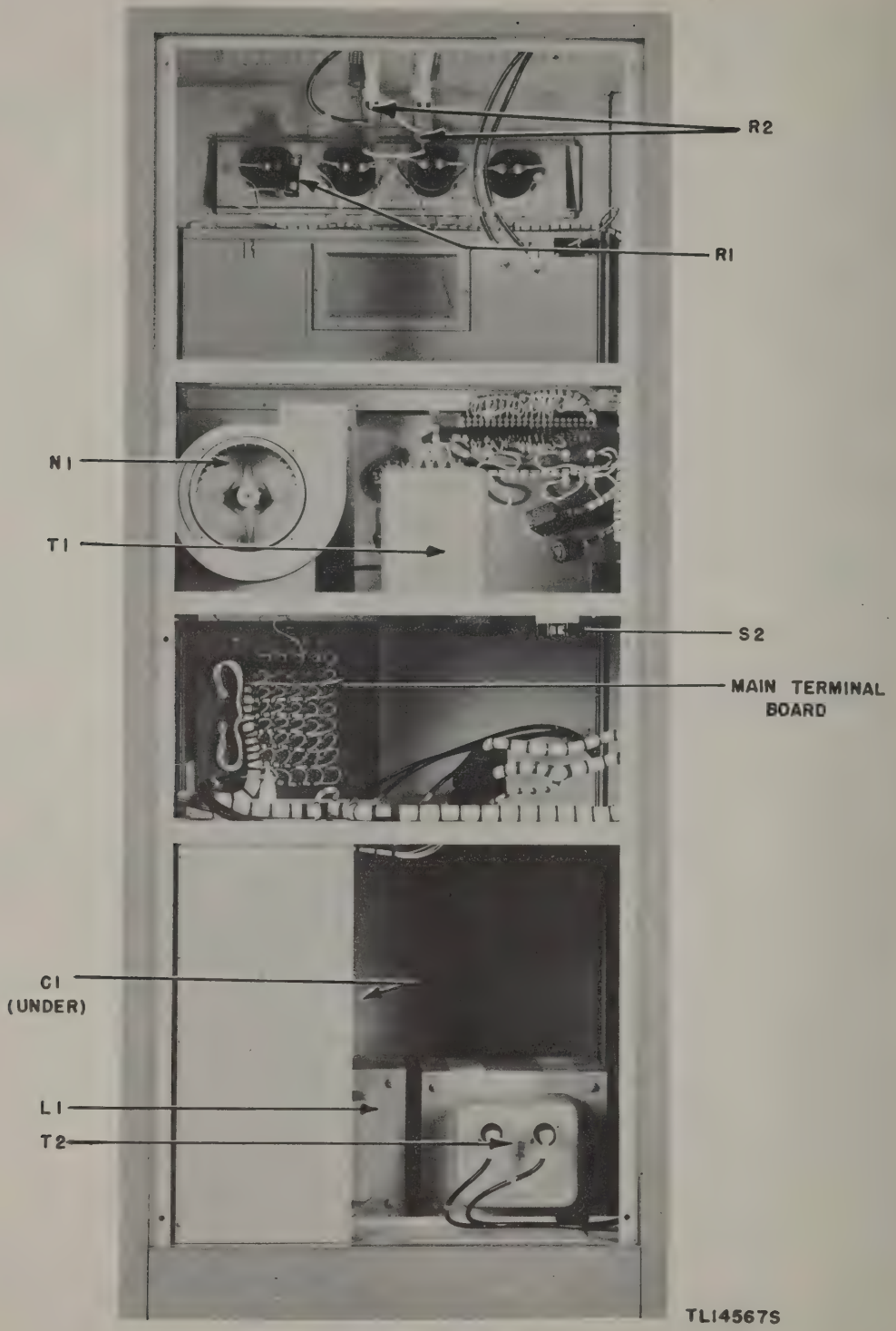


Figure 21. Modulator type 50A3, rear interior view, less components.

transformer T2. In a few modulators this lead was marked C.

e. High-voltage Filter Choke. Connect the two wires marked 55 to one terminal of high-voltage filter choke L1. Connect lead 54 to the other terminal of the choke.

f. High-voltage Filter Capacitor. Connect the end of lead 55 to one terminal of capacitor C1. Connect lead 51 to the other terminal of capacitor C1.

13. INTERCONNECTIONS BETWEEN MODULATORS TYPES 50A AND 50A3 AND ASSOCIATED EQUIPMENT.

a. Modulator Type 50A3. All interconnections between the transmitters and the rectifier and modulator are made through the cableway extending along the rear of each unit just above the base. A cover is provided for the units at either end of the transmitter equipment line. Line connections from the remote control console wall terminal box and power connections are led into the equipment through the opening in the base at one end of the equipment line. Figure 45 is a complete interconnection diagram for a station consisting of one transmitter type 96C3, one rectifier type 36A4, and one modulator type 50A3. All power and control connections are shown in a cable to simplify the diagram. The first number is the wire number and the second number is the number of the cable. The bend where the wire enters the cable indicates its direction after entering the cable. The 4,000-volt unfiltered supply from rectifier No. 1 is connected to the stand-off insulator at the back of the cabinet on shelf C. The 4,000-volt unfiltered supply from rectifier No. 2, if used, is connected to the middle stand-off insulator. The 4,000-volt modulated voltage is connected from the stand-off insulator nearest the front of the cabinet to the 4,000-volt modulated connection in the rectifier. Figures 46 to 49 give the connections for transmitter stations consisting of two or more transmitters. The wires are grouped as cables only for schematic diagram purposes. All interconnecting leads are placed at random in the cableway.

b. Modulator Type 50A. The interconnections for modulator type 50A are identical with those for modulator type 50A3 except that the main terminal board is mounted horizontally and the 4,000-volt stand-off insulators are mounted on the terminal board.

14. INSTALLATION OF TUBES.

Remove the tubes from their containers and check whether all are in good physical condition. Refer to the tube location chart for the location of the tubes (fig. 22). To insert tubes V1 to V7, align the guide of the tube pin with the keyway in the socket and push straight down. To insert tubes V10 to V15, align the large tube pins with the large socket holes and push straight down. To install the two modulator power-amplifier tubes V8 and V9, insert the tube in the socket with the pin at the side of the tube base aligned with the slot in the socket and turn the tube clockwise to the stop. Connect the two high-voltage leads from the top of the cabinet to the plate connections of the power-amplifier tubes.

15. INSTALLATION OF FUSES.

The modulator requires seven fuses. Three are the Littelfuse type and are mounted in Fuse-well type holders at the front of the modulator chassis (fig. 10). The other four are mounted in clips on the fuse panel (fig. 8). Fuse ratings are given in the following table:

FUSE	DESCRIPTION	RATING
Modulator chassis fuses:		
F1	Plate and filament transformers	5 amp, 500 v
F2	Plate and filament transformers	5 amp, 500 v
F3	Plate transformer T6	5 amp, 500 v
Fuse panel:		
F1	Blower motor	6 amp, 220 v
F2	Blower motor	6 amp, 220 v
F3	Modulator filament	3 amp, 220 v
F4	Modulator filament	3 amp, 220 v

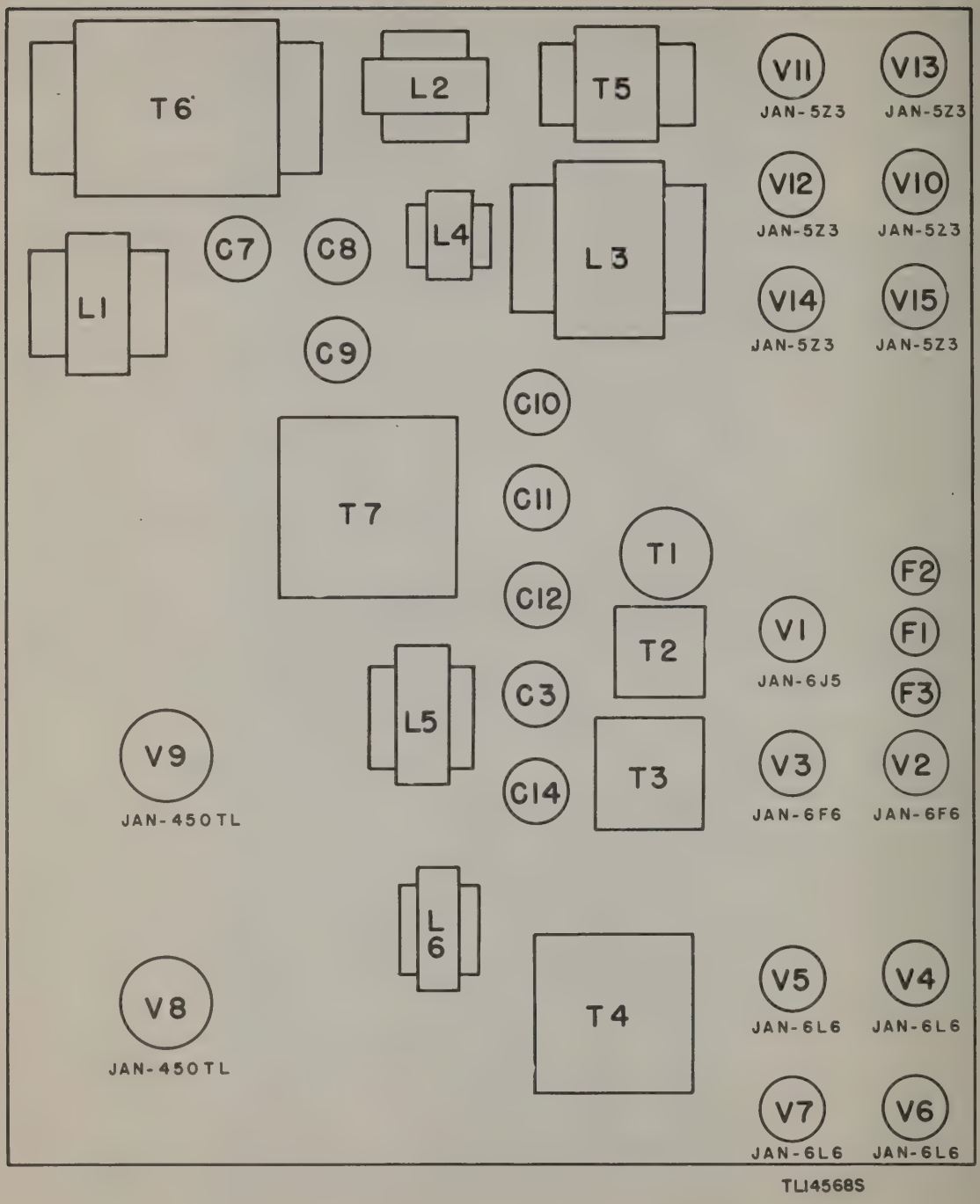


Figure 22. Modulator unit type 50A-10, tube location chart.

16. SYSTEM INSTALLATION CHECK.

The radio transmitting system, including the transmitter equipment and the remote control consoles, should be given a complete system check to determine whether there have been any errors made in the interconnctions and to determine whether all control relays are functioning properly. Since all of the equipment is remotely controlled, the system check is most conveniently made at the remote control console. See TM 11-2622 for details of the system checks to be made on the equipment. The check is made after the installation is complete and all transmitters have been tuned.

PART TWO
OPERATING INSTRUCTIONS

NOTE: For information on destroying the equipment to prevent enemy use, refer to the destruction notice at the front of the manual.

SECTION III. OPERATION

17. CONTROLS FOR MODULATORS TYPES 50A AND 50A3.

a. Meter Switch. The four-position switch at the top of the control panel (fig. 8) selects various metering circuits for checking the modulator performance. With the switch turned to AUDIO INPUT, the AUDIO LEVEL meter is connected to the audio input line from the remote control console. At AUDIO OUTPUT, the AUDIO LEVEL meter is connected to the output of the driver amplifier. With this connection the AUDIO LEVEL meter gives a relative indication of the power output of the driver amplifier. With the switch at the 3RD. AMP. A position, the DRIVER AMP meter indicates the cathode current of one side of the parallel push-pull driver amplifier. At the 3RD. AMP. B position, the DRIVER AMP meter indicates the cathode current of the other side of the parallel push-pull driver amplifier.

b. Modulator Channel Selector. The MODULATOR CHANNEL SELECTOR dial is used for local testing of the channel selection equipment. With the rectifier energized and the CHANNEL CONTROL key at the transmitter under test closed, dialing the corresponding transmitter number will connect the modulated plate-voltage circuit to the transmitter under test. Opening the transmitter CHANNEL CONTROL key should open the modulator connection to the transmitter. The last position on the dial marked A or 11 has no function.

18. ADJUSTMENTS FOR MODULATORS TYPES 50A AND 50A3.

a. The level of the audio input signal to the grid of the first amplifier is adjusted by turning potentiométer R1 (fig. 10). This adjustment determines the gain of the amplifier.

b. The bias supply voltage to the second and driver amplifiers is adjusted by moving the slider on resistor R15 (fig. 37).

c. The indication of the AUDIO LEVEL meter when connected to AUDIO OUTPUT is adjusted by turning rheostat R11 (fig. 10). This reading is purely relative and may be adjusted to suit the convenience of the operator.

d. The overload relay is adjusted by means of rheostat R18 (fig. 10). To increase the current at which the overload relay operates, turn the rheostat counterclockwise.

e. The modulator power-amplifier bias is adjusted by means of the left-hand slide on adjustable tapped resistor R16 (fig. 37). The bias relay coil current is adjusted by the right-hand slide of R16.

f. Autotransformer T2 has taps for matching a 5,000- or 7,500-ohm load. Lead number 9 is connected to terminal marked 5000 for a 5,000-ohm load and to terminal marked 7,500 for a 7,500-ohm load. The lead is normally connected to the 5,000-ohm terminal but if the transmitter is operated at such a low loading that the transmitter final-amplifier plate impedance is nearer to 7,500 ohms than to 5,000 ohms, lead 9 should be connected to the 7,500-ohm terminal. To determine the plate impedance, divide the transmitter final-amplifier plate voltage by the final-amplifier cathode current.

19. INITIAL STARTING AND TESTING PROCEDURE.

a. Preparation. Screw panel D in place and close all safety panels and doors including the large rear panel. The modulator is now ready for test in conjunction with the rectifier and transmitters. Close the three-phase a-c power switch to the rectifier and press the START button. The blower motor in the modulator

should start and all of the modulator tubes except modulator power-amplifier tubes V8 and V9 should light up. The MODULATOR BIAS meter should indicate about 210 volts. If it differs appreciably from this value, adjust the modulator bias resistor tap as explained in paragraph 18e above. Press the CHANNEL CONTROL key on the transmitter nearest the modulator, and dial the corresponding transmitter on the MODULATOR CHANNEL SELECTOR. Press the transmitter TEST KEY. If the underload relay adjustment in the transmitter is correct, modulator power-amplifier tubes V8 and V9 will light up. The modulator is now ready for test.

b. Testing.

(*1*) Turn the meter switch to AUDIO INPUT and arrange with the operator at the remote control console to put a low-level continuous tone to the audio input of the modulator. This may be accomplished by closing the tone modulation switch at the remote control console. The tone should be adjusted to make the AUDIO LEVEL meter read about 0 db. This tone should cause the MODULATOR meter to indicate 0.1 to 0.2 amperes. By increasing the tone level to a higher value, not exceeding 3 db, and by adjusting the modulator gain with potentiometer R1, the modulator power-amplifier cathode current may be adjusted to 0.36 to 0.40 amperes as indicated by the MODULATOR meter. This current is sufficient to produce 100 percent modulation of the transmitter when the transmitter is operating at 0.8 amperes plate current.

(*2*) The balance of the driver amplifier should now be checked under static conditions. With no input signal the current in each side of the push-pull amplifier should be from 47 to 53 ma, and the two currents should not differ by more than 5 percent. If they differ by more than 5 percent, interchange the tubes to bring them to a closer balance. The dynamic current of the driver amplifier should be 140 to 175 ma.

SECTION IV. EQUIPMENT PERFORMANCE CHECK LIST

20. PURPOSE AND USE OF CHECK LIST.

a. General. The equipment performance check list (par. 21) will help the operator to determine whether the modulator is functioning properly. The check list gives the item to be checked, the conditions under which the item is to be checked, the normal indications for correct operation, and the corrective measures that the operator can take. Item 1 is checked before starting, items 2 and 3 during starting and operation, and item 4 when stopping. Item 3 should be checked at least once during a normal operating period or at least four times daily during continuous operation.

b. Action or Condition. For some items the information given under the action or condition column requires pushing certain keys or adjusting certain controls to permit checking the items. For other items it represents an action that must be taken in order to check the normal indication given in the normal indications column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the operator will perceive when he checks the items. Tolerances are given for the meter readings. These readings may be considered to be satisfactory if the readings fall within these tolerances. If a meter reads outside the limits specified, trouble may be impending. Corrective measures should be taken as soon as possible on items which do not show normal indications.

d. Corrective Measures. The corrective measures listed are those which can be taken by the operator without turning the equipment in for repairs. Reference to part five in the table indicates that the correction of the trouble cannot be made during operation and that trouble shooting by a higher echelon is necessary. If the modulator is completely inoperative or if the recommended corrective measures fail to restore normal operation, trouble shooting is necessary. However, if the tactical situation demands that communication must be maintained, and the modulator is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

e. Items 1 and 2. Items 1 and 2, the preparatory and starting items, should be checked each time the modulator is placed in operation

f. Item 3. The meter readings in item 3 are correct for an a-c input voltage of 220 volts. If the input voltage exceeds this value, the meter readings will be slightly higher. Meter readings should be recorded daily so that impending break-downs, indicated by meter readings which are not normal, may be prevented. The operator must become thoroughly familiar with the normal operation of the equipment so that he may recognize, by both audible and visual means, changes such as meter readings and relay clicks which indicate improper operation of the modulator.

g. Item 4. Item 4 should be checked whenever a modulator is taken out of operation. Any abnormal conditions at this time are symptoms of trouble in the equipment which should be corrected before the next period of operation.

21. EQUIPMENT PERFORMANCE CHECK LIST.

	ITEM NO.	ITEM	ACTION OR CONDITION	NORMAL INDICATIONS	CORRECTIVE MEASURES
PREP.	1	Safety panels and doors.	Closed and latched.		
START	2	START button at rectifier.	Press.	Blower motor in modulator runs.	Replace BLOWER MOTOR fuses.
		NOTE: All starting is performed by the rectifier or remote control console.	(See TM 11-2666 and TM 11-2622.)	Filaments light (except V8 and V9).	Replace fuse F2 or F3 on Modulator type 50A-10 chassis. Refer to part five.
EQUIPMENT PERFORMANCE	3	Meter readings.	Modulator selected for use by remote operator. Meter switches to appropriate positions.		
			a. AUDIO INPUT.	a. 0 to +3 db.	a. See TM 11-2622.
			b. AUDIO OUTPUT.	b. Relative. See par. 18c.	b. Refer to part five.
			c. MODULATOR.	c. 0.36 to 0.40 amp.	c. Replace tubes V8 and V9. Refer to part five.
			d. DRIVER AMP. A. Static. Dynamic.	d. 47-53 ma. 140-175 ma.	d. If DRIVER AMP. A and B differ more than 5 per cent, refer to par. 19b. Refer to part five.
			e. DRIVER AMP. B. Static. Dynamic.	e. 47-53 ma. 140-175 ma.	e. See d. above.
			f. MODULATOR BIAS.	f. 205-215 volts.	f. Refer to par. 18. Refer to part five.
STOP	4	STOP button at rectifier.	Press.	Blower motor stops. Filaments go out.	

PART THREE

MAINTENANCE INSTRUCTIONS

SECTION V. PREVENTIVE MAINTENANCE TECHNIQUES

22. MEANING OF PREVENTIVE MAINTENANCE.

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major break-downs and unwanted interruptions in service, and to keep the equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to *prevent break-downs* and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance can not be overemphasized. A system of radio communication depends on the performance of every set. It must be *ready* to go on the air when it is needed, and it *must* operate efficiently. Therefore, it is vitally important that radio operators and repairmen maintain their radio sets properly.

NOTE: The operations in section V and VI are first and second echelon (organization operators and repairmen) maintenance. Some operations in Section IX are higher echelon maintenance.

23. DESCRIPTION OF PREVENTIVE MAINTENANCE TECHNIQUES.

a. General. Most of the electrical parts used in the modulators (Wilcox Electric types 50A and 50A3) require routine preventive maintenance. This preventive maintenance varies. Some parts require a different kind of maintenance than others. Some require more, some less. Definite and specific instructions must be followed. Hit-or-miss maintenance technique cannot be applied. This section of the manual contains these specific instructions to guide personnel assigned to perform the six basic maintenance operations, namely: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

F—Feel
I —Inspect
T—Tighten
C—Clean
A—Adjust
L—Lubricate

The first two operations show if the other four are needed. Selection of operations is based on a knowledge of field needs. For example, dust encountered on dirt roads during cross-country travel filters into the equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary tightening, cleaning, and lubrication operations, equipment becomes undependable and subject to break-downs when it is needed most.

b. Feel. The feel operation is used most often to check rotating machinery, such as dynamotors, blower motors, and drive motors, also to determine whether electrical connections and bushings are overheated. Feeling will show the need for lubrication or the existence of other defects requiring correction. The maintenance man *must* become familiar with the normal operating temperatures of motors, transformers, and other parts, to recognize signs of overheating.

NOTE: It is important to perform the feel operation as soon as possible after shut-down and always before any other maintenance is done.

c. Inspect. Inspection is the most important operation in preventive maintenance. A careless observer will overlook the evidences of minor trouble. Although these defects may not at the moment interfere with the performance of the equipment, invaluable time and effort can be saved if they are corrected *before* they lead to major and costly break-downs. To be able to recognize the signs of a defective set, make every effort to become thoroughly familiar with the indications of normal functioning. Inspec-

tion consists of carefully observing all parts of the equipment, noticing their color, placement, state of cleanliness, etc. Inspect for the following conditions:

(*1*) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(*2*) Placement, by observing that all leads and cabling are in their original positions.

(*3*) Cleanliness, by carefully examining all recesses in the units for accumulation of dust, especially between connecting terminals and binding posts. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity locations, look for fungus growth and mildew.

(*4*) Tightness, by testing any connection or mounting which appears to be loose.

d. Tighten, Clean, and Adjust. These operations explain themselves. Specific procedures to be followed in performing them are given wherever necessary throughout part three.

CAUTION: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

Whenever a loose connection is tightened, it should be moistureproofed and fungiproofed again by applying the varnish with a small brush. See section IX for details of moistureproofing and fungiproofing.

e. Lubricate. Lubrication refers to the application of grease or oil to the bearings of motors or rotating shafts. It may also mean the application of a light oil to door hinges or other sliding surfaces on the equipment. Where the need for lubrication is indicated, refer to section VII.

24. VACUUM TUBES.

NOTE: Avoid working on the tubes immediately after shut-down. Severe burns may result from contact with the envelopes of hot tubes.

a. Inspect (I).

(*1*) Inspect glass and metal tube envelopes, tube caps, and tube connector clips for accumulation of dirt and for corrosion. When tubes with loose plate caps or envelopes are found, replace the tubes if possible.

(*2*) Examine the spring clips that make contact with the plate caps of transmitter tubes for corrosion and loss of tension with resulting looseness. Also, check the condition of wires soldered to the spring clips.

(*3*) Inspect the firmness of the tubes in their sockets. Make the inspection by pressing the tubes down in their sockets and testing them for firmness in that position *not* by partially withdrawing the tubes and jiggling them from side to side. Movement of a tube tends to loosen the pins in the base and unnecessarily spreads the contacts in the socket. It is desirable to inspect the sockets of the tubes at the time the tubes are removed.

(*4*) When it is necessary to remove a tube from its socket, especially if it is a high-powered tube, great care must be used. Never jar a warm tube; the elements may be displaced. Connections to the plate caps and grid caps must always be removed.

b. Tighten (T). Tighten all loose contacts to the tube sockets or to the tubes. If the connections are dirty or corroded, clean them before tightening. Do *not* apply excessive pressure in the tightening operation.

c. Clean (C).

(*1*) Clean the tubes, if necessary. Tubes operated at high voltages and with exposed plate connections, such as in the transmitter, must be kept free of dirt and dust because of possible leakage between plate terminals. In contrast, tubes operating at low voltages and not having exposed plate caps do not require frequent cleaning. However, do not permit dirt to accumulate on low-voltage tubes.

(*2*) Remove dust and dirt from the glass or metal envelopes with a clean, lint-free, dry cloth. If proper care is used, the plate caps may be cleaned with a piece of #0000 sandpaper by wrapping the paper around the cap and *gently* rubbing the surface. Excessive pressure is not needed; nor is it necessary to grip the cap tightly. Wipe the caps with a clean dry cloth.

(*3*) The tube pins, when corroded or dirty, may be cleaned with fine sandpaper.

(*4*) When tube sockets are cleaned and the contacts are accessible, fine sandpaper may be used to remove corrosion, oxidation, and dirt.

d. Adjust (A). Adjust loose tube socket clips. Do not flatten the clips during adjustment. Flattened clips do not make adequate contact with the tube pins. Adjustment can be made with a pair of long-nose pliers.

25. PLUGS AND JACKS.

a. Inspect (I).

(*1*) Inspect the prongs or barrels of the plugs for accumulation of dirt and corrosion.

(*2*) Inspect the firmness of the plugs in their respective jacks.

(*3*) Inspect plugs and jacks for loose connections and for loose locking nuts.

b. Tighten (T). Tighten all loose locking nuts on plugs and jacks. Do *not* apply excessive pressure in the tightening operation.

c. Clean (C).

(*1*) Clean the plugs and jacks, if necessary.

(*2*) Clean the barrel or prongs of the plugs, when corroded or dirty, with #0000 sandpaper.

(*3*) If the contacts are accessible when cleaning jacks, use fine sandpaper to remove corrosion, oxidation and dirt.

d. Adjust (A). Adjust loose jack clips. Do not adjust tighter than necessary to make a firm connection. Excessive adjustment may result in broken or damaged clips. Adjustments can be made with a small screw-driver or with long-nose pliers, depending on the type of jack.

26. CABLES AND CONNECTORS.

a. Inspect (I). Inspect the cables for deterioration, excessive wear, cuts, and kinks. Give special attention to junction points and connectors. Inspect for improper placement of cables which places them under strain.

b. Tighten (T). Tighten the nuts which hold the connectors together. Tighten clamps which hold cable in connectors.

c. Clean (C). Clean connectors and pins with a cloth or, if necessary, with Polish, Metal, Paste, or #0000 sandpaper. If paste metal polish is used, be sure to remove all residue of the polish after the cleaning operation in order to maintain good contact. Remove grease and oil from the cable or associated parts with a soft rag dampened with Solvent, Dry-cleaning.

27. RHEOSTATS AND POTENTIOMETERS.

a. Inspect (I). Check for loose terminal connections and accumulations of dirt and grease. Check for excessive corrosion on exposed contact points on switches. Check for evidence of overheating of rheostats.

b. Clean (C). Remove accumulation of grease and dirt with a soft clean cloth dampened with dry-cleaning solvent (SD).

28. CAPACITORS.

a. Inspect (I).

(*1*) Inspect the terminals of large fixed capacitors for corrosion and loose connections. Observe the mounting carefully to discover loose mounting screws or brackets. Examine the leads for poor insulation, cracks, and evidence of dry rot. Cut away frayed strands on the insulation. If the wire is exposed, replace it with a new wire. The terminals of the capacitor should not show cracks or breaks.

(*2*) Inspect the case of each large fixed capacitor thoroughly for leaks, bulges, and discoloration. Whenever an oil-filled capacitor is found to be leaking oil, remove it and replace if possible. Equipment may operate with a leaky capacitor. However, replacement should be made as soon as possible to avoid breakdown.

b. Tighten (T).

(*1*) Tighten loose terminals, mountings, and connections on the capacitor.

(*2*) Carefully tighten the retaining nuts on the insulation bushings, if leakage occurs around the gasket of oil-filled capacitors. When tightening a nut, be careful not to break the bushing or damage the gasket.

c. Clean (C). Clean the cases of fixed capacitors, the insulating bushings, and any connections that are dirty or corroded. The capacitor cases and bushings can usually be cleaned with a dry cloth, but if the deposit of dirt is hard to remove, moisten the cloth in dry-cleaning solvent (SD).

29. RESISTORS.

a. Inspect (I). Inspect the coating of the vitre-

ous-enameled resistors for signs of cracks and chipping, especially at the ends. Examine the bodies of all types of resistors for blistering, discoloration, and other indications of overheating, and replace them only after the cause of the overheating has been located and corrected. Inspect leads and all other connections for corrosion, dirt, dust, looseness, and broken strands in the connecting wires. Check the security of all mountings. Do not attempt to move resistors with pigtail connections, because there is danger of breaking the connections at the point where they enter the body of the resistor. Such defects cannot be repaired.

b. Tighten (T). Tighten resistor connections and mountings whenever they are found to be loose. If a resistor is allowed to remain loose, vibration may break the connection or damage the body.

c. Clean (C).

(*1*) Clean all carbon resistors with a small brush.

(*2*) The vitreous-enameled resistors must be kept clean to avoid leakage between the terminals. They will ordinarily be wiped with a dry cloth. However, if the dirt deposit is unusually hard to remove, use a dry-cleaning solvent (SD).

(*3*) Resistors with discolored bodies cannot be cleaned. Discoloration indicates that there has been overloading and overheating at some time prior to the inspection. The discoloration is probably due to circuit trouble which requires analysis and correction. Troubleshooting procedures are described in part five.

NOTE: When fungiproofed resistors are heated, a harmless brown stain may appear.

30. SWITCHES.

a. Inspect (I).

(*1*) Inspect the mechanical action of each switch, and look for signs of dirt or corrosion on all exposed elements. In some cases, it will be necessary to examine the elements of the switch visually; in others, the action of the switch is checked by flipping the control knob or toggle, or by pressing the switch button and noting the freedom of the movement and the amount of spring tension.

(*2*) Examine the ganged switches to see if the contacts are clean. The inspection is visual. Do not pry the leaves of the switch apart. The rotary members should make good contact with the stationary members, and as the former slides into the latter, a spreading of the stationary contact leaves should be noticeable. The switch action should be free. The wiping action of the contacts usually removes any dirt at the point of contact.

b. Tighten (T). Tighten the mounting nuts on all switches. Loose mounting nuts cause unnecessary strain on switch wiring when the switch is rotated.

c. Clean (C). Clean the exterior surfaces of switches with a stiff brush moistened with dry-cleaning solvent (SD).

d. Adjust (A). Stationary contacts of rotary switches should be adjusted only if poor or no contact is indicated. Adjustment should be done carefully until a noticeable spreading of the stationary contact occurs when it is engaged by the rotary contact. Use long-nose pliers for adjustment.

e. Lubricate (L). Refer to Section VII.

31. TRANSFORMERS AND CHOKES.

a. Inspect (I).

(*1*) Inspect the terminals of transformers and chokes for corrosion and loose connections. Carefully inspect the mountings to discover loose mounting screws, studs, or brackets. Examine the leads for poor insulation, cracks, and evidences of dry rot. Cut away frayed strands on the insulation. If the wire is exposed, wrap it with friction tape.

(*2*) Thoroughly inspect the terminal insulators of the transformers and chokes for cracked or broken insulators.

(*3*) Inspect the transformers and chokes for leaks of insulating compound or discoloration due to overheating.

b. Tighten (T). Tighten loose terminals, mountings, and connections to transformers and chokes when necessary. Do not break the bushing or damage the gasket.

c. Clean (C). Clean the cases of the transformers and chokes, the insulating bushings, and all connections that are dirty or corroded. The cases and bushings can usually be cleaned

with a clean dry cloth. However, if the deposit of dirt and grease is hard to remove, moisten the cloth in dry-cleaning solvent (SD).

32. RELAYS.

a. Inspect (I).

(*1*) Inspect the relays for corrosion, grease, and dirt.

(*2*) Inspect the contact points for dirt and corrosion.

b. Clean (C).

(*1*) Remove corrosion, grease, and dirt with a soft, dry rag or soft brush. Dirty contacts may be cleaned with a clean rag moistened with dry-cleaning solvent (SD).

(*2*) In case of excessive pitting and corrosion the relay should be replaced. However, if the pitting is not too severe the contacts may be burnished with a relay burnishing tool using care to keep contact surfaces parallel and not to spring the contact arms.

NOTE: For more detailed information on relays, refer to paragraphs 111, 113, 114, 115, 121, and 122 in TB SIG 178.

33. TERMINAL BOARDS AND INSULATORS.

a. Inspect (I). Check terminal boards for accumulation of dirt and grease. Inspect connections for tightness.

b. Tighten (T). Tighten all connections found loose with the proper size screwdriver or wrench. Excessive tightening may damage terminal screws or crack insulators.

c. Clean (C). Remove accumulation of grease and dirt with a clean, dry cloth. For further cleaning instructions, refer to paragraph 127 in TB SIG 178.

34. BLOWER.

a. Feel (F). Feel the blower as soon as possible after shut-down so that overheated bearings and other defects causing overheating can be detected.

b. Inspect (I). Check the rotation of the fan to see that it turns freely. Inspect motor connections for loose or frayed wires, and for signs of deterioration.

c. Tighten (T). Tighten all assembly and mounting screws on the blower.

d. Clean (C). Remove all accumulated dust and foreign matter from the blower openings. Use a stiff brush for this purpose. Remove accumulation of dirt and grease from the motor frame.

e. Lubricate (L). Refer to section VII.

35. AIR FILTER.

a. Inspect (I). Inspect the fiber-glass air filter for accumulation of dust.

NOTE: Replacement filters will be of the reusable steel type.

b. Clean (C).

(*1*) Remove accumulation of dust from the filter with a dry cloth, soft brush, or dry compressed air. Do not use damp or oily cloths to remove the dust. Replace air filter if it cannot be cleaned. Cleaning instructions for the reusable steel filter are given in TB SIG 178.

(*2*) Remove dust from inside of cabinet with a dry cloth, soft brush, or dry compressed air.

36. METERS.

Meters are extremely delicate instruments and must be handled very carefully. They require very little maintenance. They are precision instruments and ordinarily cannot be repaired in the field.

a. Inspect (I). Inspect the leads and connections to the meters. Look for loose, dirty, and corroded connections. Look for cracked or broken glasses. Since the movement of a meter is extremely delicate, its accuracy will be seriously affected if the glass is broken and dirt and moisture filter through.

b. Tighten (T). Tighten all connections found loose. Any loose meter wires should be inspected for dirt or corrosion before they are tightened. The tightening of meter connections requires special care since careless handling can easily crack the meter case.

c. Clean (C). Meter cases can usually be cleaned with a dry cloth. If cleaning is difficult, the cloth should be dampened with dry-cleaning solvent (SD). Dirty connections may be cleaned with a small brush dipped in dry-cleaning solvent (SD) or with a small piece of cloth dipped in the solvent.

d. Adjust (A). The meters in the transmitter should indicate zero when the equipment is

turned off. Before deciding whether a meter needs readjusting, tap the meter case *lightly* with the tip of the finger. This helps the needle to overcome the slight friction which sometimes exists at the bearings and prevents an otherwise normal meter from coming to rest at zero. If adjustment is needed, insert the tip of a very thin screwdriver in the slotted screw head located below the meter glass, and slowly turn the adjusting screw until the pointer is at zero. Lightly tap the meter case again and view the meter face and pointer *full on* and not from either side. Avoid turning the adjusting screw too far.

37. CABINETS, CHASSIS, AND MOUNTINGS.

a. Inspect (I). Inspect the outside and inside of the cabinet thoroughly, paying strict attention to every detail. Check the ventilator mountings, the panel screws, and the zero settings of the meters (par. 36). Examine the panels for loose knobs, dials, and switches. Examine air filters for dirt.

b. Clean (C). Clean each cabinet, outside and in, with a clean dry cloth. Use dry compressed air to blow out all accumulated dirt and dust. If the air filters cannot be cleaned with compressed air or a stiff brush (par. 35) replace them with clean filters. Repaint any surface that is found scratched, rusted, or chipped.

c. Tighten (T). Tighten all mounting bolts, panel screws, and control knobs found loose.

d. Lubricate (L). Refer to section VII.

SECTION VI. ITEMIZED PREVENTIVE MAINTENANCE

38. INTRODUCTION.

For ease and efficiency of performance, preventive maintenance on modulators types 50A and 50A3 will be broken down into operations that can be performed at different time intervals. In this section the preventive maintenance work to be performed on the modulators at specified time intervals is broken down into units of work called items. The general techniques involved and the application of FITCAL operations in performing preventive maintenance on individual parts are discussed in section V. These general instructions are not repeated in this section. When performing preventive maintenance, refer to section V if more information is required for the following items. All work is to be performed with the power removed from the equipment. After preventive maintenance has been performed on a given day, the equipment should be put into operation and checked for satisfactory performance. (See par. 21, Equipment Performance Check List.)

39. PREVENTIVE MAINTENANCE TOOLS AND MATERIALS.

The following materials will be needed in performing preventive maintenance:

Common hand tools

Clean cloth

#0000 sandpaper

Crocus cloth

Paste metal polish (Signal Corps stock No. 6G1516)

Fine file

Dry-cleaning solvent (SD)

NOTE: Gasoline will not be used as a cleaning fluid for any purpose. Solvent, Dry-cleaning, is available, as a cleaning fluid, through established supply channels. Oil, Fuel, Diesel, may be used for cleaning purposes when dry-cleaning solvent (SD) is not at hand. Carbon tetrachloride will be used as a cleaning fluid only on electrical wiring and electrical mechanisms which cannot be cleaned with an inflammable solvent because of the fire hazard.

40. ITEM 1, EXTERIOR OF MODULATOR (figs. 3, 4, and 5).

Operations.

ITCL	Cabinet.
ITC	Control knobs.
IC	Inspection door glass.
ICA	Meter panel and meters.

ITC Switches.

ITC Dials.

Remarks. Tighten all control knobs and dials found loose. Use the proper screwdriver or wrench. Tighten any loose locknuts on switches and shaft bearings extending through the panel, using care not to rotate the entire assembly.

41. ITEM 2, FUSE PANEL (fig. 7).

Preliminary Steps. Remove all power from the modulator.

Operations.

IC Fuses.

ITC Fuse clips.

IC Fuse panel.

42. ITEM 3, MODULATOR CHASSIS (figs. 10 and 37).

Preliminary Steps. Remove all power from the cabinet. Open the door to shelf A and remove the rear panel. Short all high-voltage capacitors with a shorting stick. Disconnect plugs and jacks. Remove the modulator chassis from the cabinet.

Operations.

ITCA Tubes and sockets.

ITCA Plugs and jacks.

ITC Capacitors.

ITC Resistors.

FITC Transformers and chokes.

ITC Insulators.

43. ITEM 4, AUXILIARY CONTROL RELAY UNIT (figs. 11, 12, and 40).

Preliminary Steps. Remove all power from the cabinet. Open the door to shelf C. Remove the rear panel. Short-circuit the high-voltage terminals with a shorting stick. Remove the top panel of the auxiliary control relay unit to reach the interior.

Operations.

IC Relays.

ICA Fuse and fuse holder.

FITC Transformers.

ITC High-voltage terminals.

ITCA Plugs and jacks.

ITC Cables and wiring.

44. ITEM 5, DIALING UNIT (figs. 13, 14, and 39).

Preliminary Steps. Remove all power from the cabinet. Open the door to shelf C. Remove the rear panel. Short-circuit the high-voltage terminals with a shorting stick. Disconnect cables and remove the dialing unit from the cabinet. Remove the cover and one of the side panels.

Operations.

IC Relays.

ITC Capacitors.

ITC Resistors.

IC Rectifier.

ITCA Plugs and jacks.

ITC Cables and wiring.

45. ITEM 6, BLOWER AND AIR FILTER (figs. 4, 9, and 17).

Preliminary Steps. Remove all power from the cabinet. Remove the rear panel and short-circuit all high-voltage capacitors and high-voltage terminals with a shorting stick.

Operations.

FITCL Blower.

IC Air filter.

46. ITEM 7, CABLES AND TERMINAL BOARDS (figs. 7, 9, 16, 17, and 21).

Operations.

ITC Cables and connectors.

ITC Terminal boards and insulators.

ITCA Plugs and jacks.

47. PREVENTIVE MAINTENANCE CHECK LIST.

The following check list is a summary of the preventive maintenance operations to be performed on modulators types 50A and 50A3. The suggested time intervals shown on the check list may be reduced at any time by the local commander. For best performance of the equipment perform operations at least as frequently as called for in the check list. The echelon column indicates which operations are first echelon maintenance and which operations are sec-

ond echelon maintenance. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITCA appear in the operations column, the item to be treated must be inspected (I), tightened (T), cleaned (C), and adjusted (A).

ITEM NO.	OPERATIONS	ITEM	WHEN PERFORMED Weekly	Monthly	Echelon
1	ITC	Exterior of modulator.	x		1st
1	L	Cabinet door hinges.		x	1st
2	ITC	Fuse panel.	x		1st
3	FITCA	Modulator chassis.	x		1st
4	FITCA	Auxiliary control relay unit.	x		1st
5	ITCA	Dialing unit.	x		1st
6	FITC	Blower and air filter.	x		1st
6	FITCL	Blower motor.		x	1st
7	ITCA	Cables and terminal boards.	x		1st

NOTE: X indicates when operations are to be performed.

F Feel I Inspect T Tighten C Clean A Adjust L Lubricate

SECTION VII. LUBRICATION

48. APPROVED LUBRICANTS FOR MODULATORS TYPES 50A AND 50A3.

The following table lists the lubricating material necessary in servicing the modulators.

SYMBOLS	STANDARD NOMENCLATURE
OE	Oil, Engine
PS	Oil, Lubricating, Preservative, Special
PET	Petrolatum

49. LUBRICATION INSTRUCTIONS.

a. General. Clean the internal parts of the modulators using applicable brush, air pressure, or suction device once every 2 weeks. Inspect the air filters and replace them when sufficient dust and dirt content requires a new filter.

b. Blower Motor. Lubricate the blower motor by applying 6 to 8 drops engine oil (OE) to the bearings through the snap-top oil cups. Apply the oil by dipping a piece of 22 B & S gauge wire ½ inch into the lubricant, withdrawing the wire, and applying drops where specified.

c. Switches. If necessary, lubricate the wiping contacts with petrolatum (PET) or special preservative lubricating oil (PS). Use lubricant very sparingly. For further information on lubricating switches refer to TB SIG 178, paragraph 125.

d. Door Latches and Hinges. Apply 1 or 2 drops engine oil to the door latches and hinges every month. Do not use excessive oil. Wipe off any excess oil.

SECTION VIII. SPECIAL TOOLS

50. SHORTING STICK.

It will be necessary for the maintenance personnel to construct a safety shorting stick and several jumper wires. The suggested method of construction is as follows (fig. 23):

a. Secure a dry piece of wood or some other material which is a good electrical insulator. It should be about 36 inches long and about 1

inch square. The latter dimension is not very important. Securely fasten a piece of copper or brass rod (or thin tubing) to one end of the stick in such a manner that the rod extends 6 inches beyond the end of the stick. The free end of the rod should be bent in the form of a hook. Solder a piece of heavy flexible hook-up wire, about 18 inches long, to the metal rod at the point where it is fastened to the stick. Attach a heavy clip to the free end of the wire.

b. The jumper wires are made from heavy flexible wire, about 18 inches long, with heavy clips attached to each end. These are intended for use as shorting links across high-voltage capacitors in components that are being repaired or cleaned.

SECTION IX. MOISTUREPROOFING AND FUNGIPROOFING

51. GENERAL.

a. When equipment is operated in highly humid climates, excessive failure of parts and decreased operating efficiency are usually caused by the accumulated effects of moisture, rather than by inferior parts. Rapid temperature changes accompanied by fog, rain, dew, or high humidity promote such failures.

b. The effects of moisture on resistors, capacitors, coils, chokes, transformer windings, terminal boards, and insulating strips can be recognized in the form of corrosion, low insulation resistance, flash-overs, and cross talk. Moisture also accelerates fungus growth which increases these effects.

52. REDUCING FAILURES.

a. A moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. The treatment consists of applying a film of moisture- and fungi-resistant varnish to all susceptible parts of the equipment. This film provides a nonwetting surface. Equipments which have been treated have been marked with the letters MFP and the date of treatment. Equipments not marked should be examined, and if treatment has not been applied, the equipment should be returned to third or higher echelon maintenance units for treatment.

b. TB SIG 13 (and Changes), Moistureproofing and Fungiproofing Signal Corps Equipment, contains a detailed description of this treatment.

c. Re-treatment may be required after a period of use. Need for this re-treatment is indicated by excessive failures or by the effects listed in paragraph 51 b.

53. TREATING EQUIPMENT AFTER REPAIRS.

If the coating of protective varnish has been punctured or broken during repair and if complete treatment is not needed to reseal the equipment, brush-coat the affected part. Be sure the break is completely sealed.

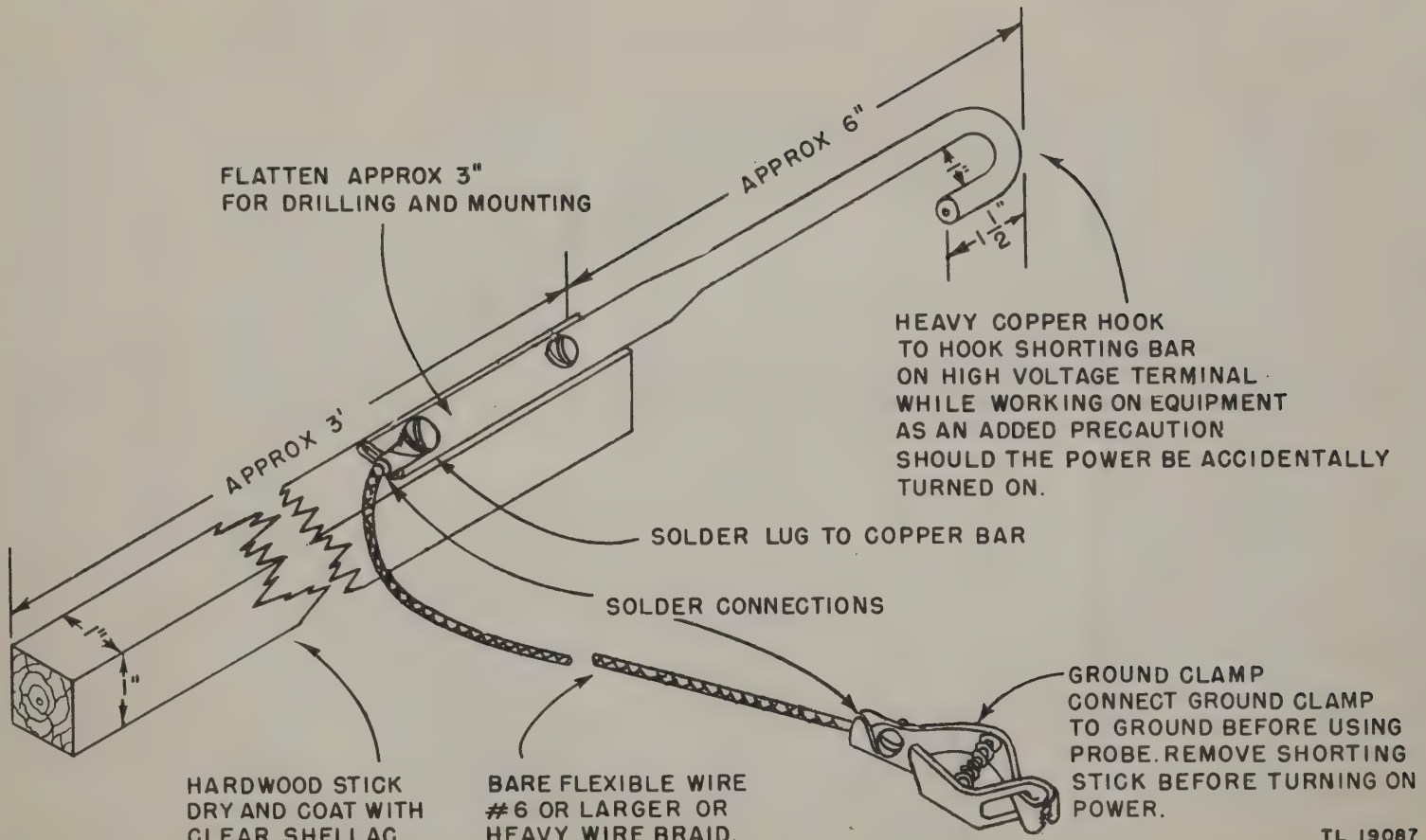


Figure 23. Shorting stick.

PART FOUR

AUXILIARY EQUIPMENT

(NOT USED)

PART FIVE

REPAIR INSTRUCTIONS

NOTE: Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form No. 54 (Unsatisfactory Report).

SECTION X. THEORY OF EQUIPMENT

54. GENERAL.

Modulators types 50A and 50A3 are designed to furnish audio power for plate modulation of radio transmitters (Wilcox Electric types 96C, 96C3, 96-200B, and 96-200C). Audio-frequency signals and dialing tones are connected over a line from a remote control console. Relaying circuits are provided for connecting the modulator to any one of 10 radio transmitters to which the modulator may be connected. The circuits are separated into several groups: the first, second, driver, and modulator power amplifiers; plate and bias supplies; dialing unit; and auxiliary control relay unit. These various circuit components are described below. There is no electrical difference between models 50A and 50A3. Figure 25 is a block diagram and figure 44 is a schematic diagram of the modulator.

55. INPUT CIRCUITS.

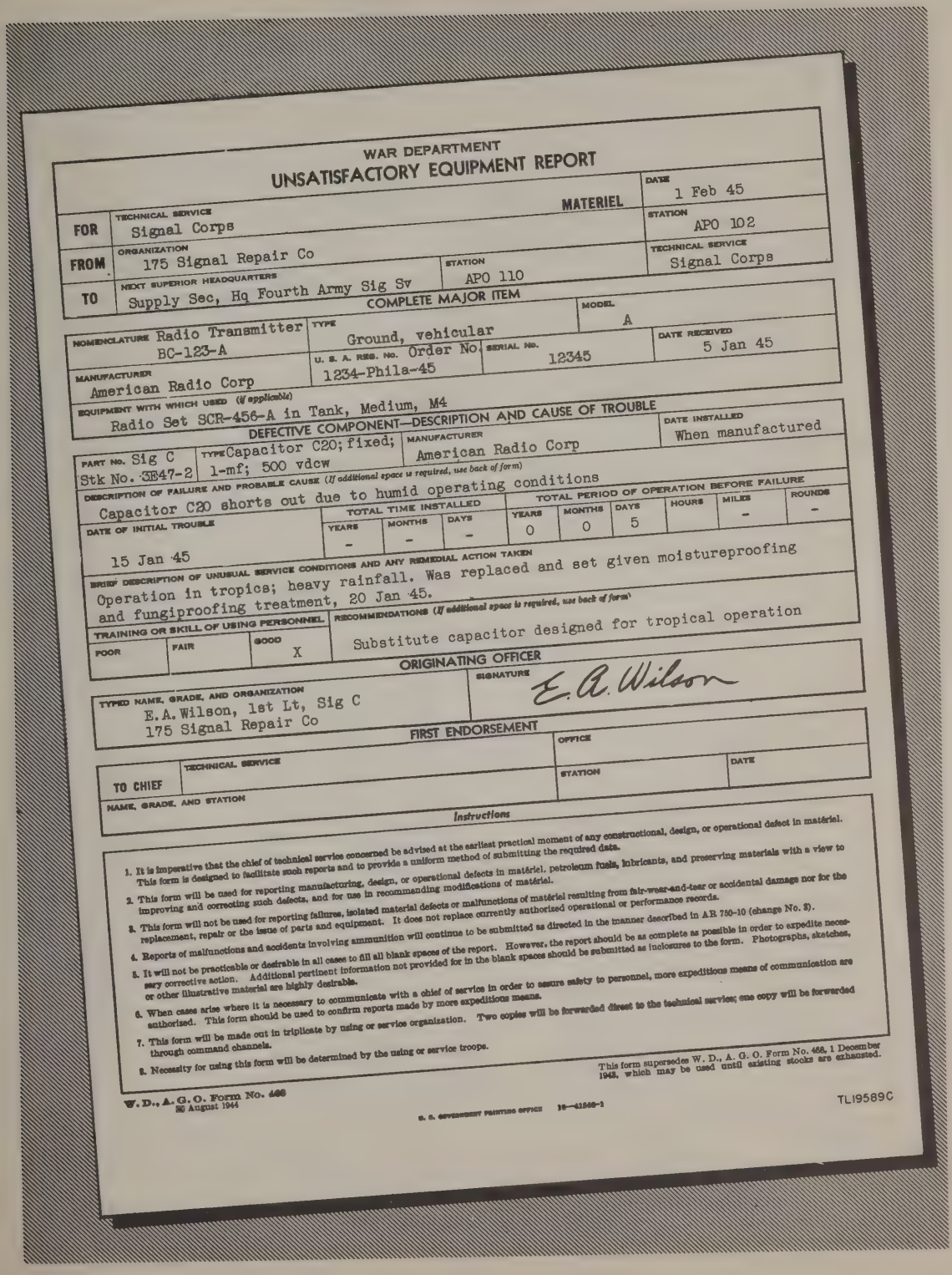
The audio signal and dial tones from the remote control console to which the modulator is connected are fed to the primary winding of transformer T1 on the auxiliary control relay unit chassis type 169D. The 60-cycle dialing tone is taken from the primary of transformer T1 (169D) to rectifier D1 in dialing unit type 168C. The rectified output of rectifier D1 performs control functions described in paragraph 56. The audio-frequency signal is taken from the secondary of T1 (169D) to the primary of input transformer T1 on the modulator type 50A-10 chassis. The secondary of T1 (50A-10) is connected to the grid of first amplifier tube V1. During a dialing operation, the primary of T1 (50A-10) is grounded to prevent the 60-cycle tone from being amplified. The ungrounded side of the primary winding of T1 (50A-10) is connected through selector switch S1 to AUDIO LEVEL meter M3 for measuring the input level.

56. FIRST AMPLIFIER.

Figure 26 is a partial schematic diagram of the first amplifier. The audio-frequency signal from the secondary of input transformer T1 (50A-10) is connected across gain control resistor R1. The slider on R1 connects to the grid of tube V1. Cathode bias is furnished by the voltage drop across resistor R2. Capacitor C1 bypasses audio-frequency currents to ground. Plate voltage is supplied through plate-load resistor R3. Capacitor C9 is part of the filter circuit of the direct-current plate supply. To minimize distortion resulting from transformer saturation, the d-c plate currents are blocked from the interstage transformer T2 by capacitor C2. This capacitor, however, has low impedance to the audio-frequency currents. The output terminal of transformer T2 is connected to the grids of the second amplifier.

57. SECOND AMPLIFIER.

Figure 27 is a partial schematic diagram of the second amplifier. The audio-frequency output of transformer T2 is fed directly to the grids of tubes V2 and V3. Resistor R4 fur-



WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

FOR	TECHNICAL SERVICE: Signal Corps — MATERIEL		DATE: 1 Feb 45
FROM	ORGANIZATION: 175 Signal Repair Co	STATION: APO 110	STATION: APO 102
TO	NEXT SUPERIOR HEADQUARTERS: Supply Sec, Hq Fourth Army Sig Sv		TECHNICAL SERVICE: Signal Corps

COMPLETE MAJOR ITEM

NOMENCLATURE: Radio Transmitter BC-123-A	TYPE: Ground, vehicular		MODEL: A
MANUFACTURER: American Radio Corp	U. S. A. REG. No.: Order No. 1234-Phila-45	SERIAL NO.: 12345	DATE RECEIVED: 5 Jan 45

EQUIPMENT WITH WHICH USED (*If applicable*): Radio Set SCR-456-A in Tank, Medium, M4

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE

PART NO.: Sig C Stk No. 3E47-2	TYPE: Capacitor C20; fixed; 1-mf; 500 vdcw	MANUFACTURER: American Radio Corp	DATE INSTALLED: When manufactured

DESCRIPTION OF FAILURE AND PROBABLE CAUSE (*If additional space is required, use back of form*): Capacitor C20 shorts out due to humid operating conditions

DATE OF INITIAL TROUBLE	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE					
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
15 Jan 45	-	-	-	0	0	5		-	-

BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN: Operation in tropics; heavy rainfall. Was replaced and set given moistureproofing and fungiproofing treatment, 20 Jan 45.

TRAINING OR SKILL OF USING PERSONNEL: POOR — FAIR — GOOD: X

RECOMMENDATIONS (*If additional space is required, use back of form*): Substitute capacitor designed for tropical operation

ORIGINATING OFFICER

TYPED NAME, GRADE, AND ORGANIZATION: E. A. Wilson, 1st Lt, Sig C, 175 Signal Repair Co	SIGNATURE: E. A. Wilson

FIRST ENDORSEMENT

TO CHIEF	TECHNICAL SERVICE	OFFICE	
NAME, GRADE, AND STATION		STATION	DATE

Instructions

1. It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in matériel. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.
2. This form will be used for reporting manufacturing, design, or operational defects in matériel, petroleum fuels, lubricants, and preserving materials with a view to improving and correcting such defects, and for use in recommending modifications of matériel.
3. This form will not be used for reporting failures, isolated material defects or malfunctions of matériel resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.
4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (change No. 2).
5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches, or other illustrative material are highly desirable.
6. When cases arise where it is necessary to communicate with a chief of service in order to assure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.
7. This form will be made out in triplicate by using or service organization. Two copies will be forwarded direct to the technical service; one copy will be forwarded through command channels.
8. Necessity for using this form will be determined by the using or service troops.

This form supersedes W. D., A. G. O. Form No. 468, 1 December 1943, which may be used until existing stocks are exhausted.

W. D., A. G. O. Form No. 468
30 August 1944

U. S. GOVERNMENT PRINTING OFFICE 16—41548-1

TL19589C

Figure 24. W.D., A.G.O. Form No. 468 with sample entries.

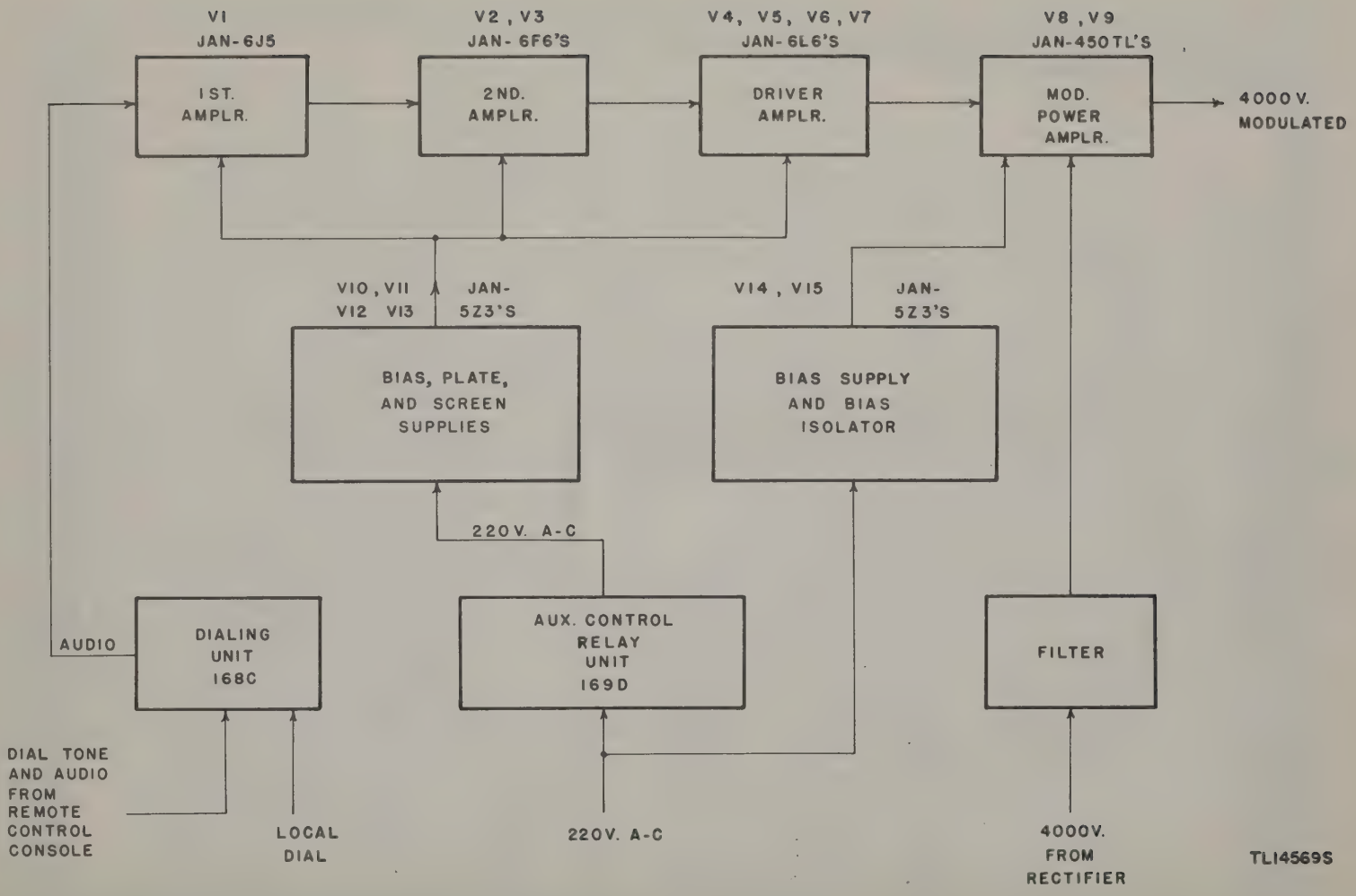


Figure 25. Modulators types 50A and 50AS, block diagram.

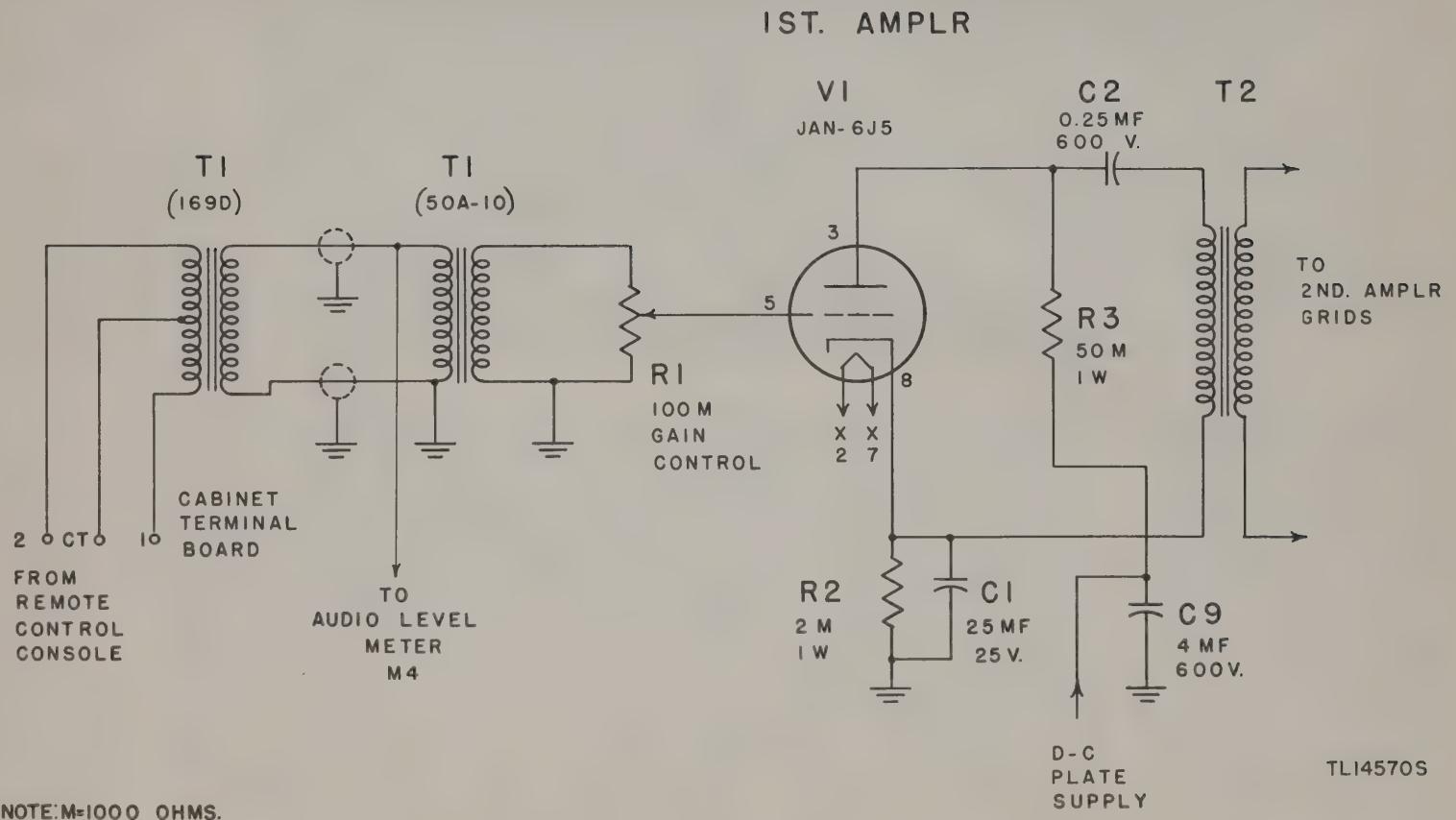


Figure 26. First amplifier, partial schematic diagram.

nishes the proper secondary load for transformer T2. These tubes are triode-connected power pentodes, and are operated in push-pull. Bias is supplied through the center tap of the secondary of T2 from the slider on resistor R15 which is across the output of the low-voltage bias supply. The plates of V2 and V3 operate into transformer T3 which supplies the grid circuit of the driver amplifier. Plate voltage is supplied to V2 and V3 through the center tap on the primary of transformer T3.

58. DRIVER AMPLIFIER.

Figure 28 is a partial schematic diagram of the driver amplifier. The driver amplifier comprises four tubes connected in push-pull parallel. The audio-frequency signal from transformer T3 is connected directly to the grids of tubes V4 and V5, and, through antiparasitic resistors R8 and R9, to the grids of V6 and V7. Bias is supplied through the center tap of the secondary winding of transformer T3 from the slider on resistor R15 which is across the low-voltage bias supply. The bias is adjusted for class AB2 operation (control grids driven positive). The cathodes of tubes V4 and V6 are grounded through metering resistor R5, and the cathodes of tubes V5 and V7 are grounded through metering resistor R6. Connections are made from R5 and R6 to DRIVER AMP meter M3 on the front panel through selector switch S1. Tubes V4, V5, V6 and V7 should be selected to give approximately equal cathode currents. Capacitors C3 and C4 in the plate circuit help stabilize the driver amplifier. Resistor R7 connecting the plates of V4 and V6, and resistor R10 connecting the plates of V5 and V7, are antiparasitic resistors to suppress high-frequency oscillations. Inverse feedback to further stabilize the stage is obtained by resistor-capacitor networks R21-C15 and R22-C16. The output of the driver amplifier is connected through driver transformer T4 to the grid circuit of the modulator power amplifier. Plate voltage is supplied to the tubes of the driver amplifier through the center tap of the primary of T4.

59. MODULATOR POWER AMPLIFIER.

Figure 29 is a partial schematic diagram of the modulator power amplifier. Figure 44 is a schematic diagram of the modulator. The modulator power-amplifier tubes V8 and V9 operate as a class B push-pull amplifier. The grids of V8 and V9 are driven by the output of the driver amplifier through driver transformer T4. The secondary of T4 is split to permit driver output level measurements. Grid bias is supplied from a separate grid-bias supply through resistors R12 and R13, and the windings of transformer T4. Resistors R12 and R13 are shunted by resistor R11. AUDIO LEVEL meter M4 is connected across resistor R11 by means of selector switch S1 on the control panel. Resistor R11 is adjusted to give the desired indication on meter M4 for normal audio input. Its reading is purely relative. MODULATOR BIAS meter M1 is permanently connected to indicate the bias voltage. The bias voltage is adjusted by the tap on resistor R16. A 10,000-ohm load resistor R14 is connected across the grids of tubes V8 and V9 to furnish the proper plate-load impedance to the driver amplifier tubes. The plates of V8 and V9 operate into the modulation autotransformer T2. Connections are made from taps on T2 to the final-amplifier plate circuit in the transmitter which is being modulated. Taps at 5,000 and 7,500 ohms are provided for matching the modulator power-amplifier plate impedance to the transmitter final-amplifier plate impedance so that tubes V8 and V9 in the modulator may be operated at the proper plate load. Under normal operation for full-power output of the transmitter, the connection is made to the 5,000-ohm tap. Plate voltage is supplied through T2 from the 4,000-volt d-c supply. The d-c supply is filtered by the filter network consisting of choke L1, capacitor C1, and resistor R2. The cathodes of V8 and V9 are grounded through MODULATOR meter M2, which indicates the total d-c cathode current, and through the bias protection resistor R19 and modulator overload relay S4. See paragraph 62 for a discussion of the bias and overload protection circuits.

60. POWER SUPPLIES.

a. General. All of the d-c power required by the modulator, except the +4,000 volts for the modulator power-amplifier plates and +12 volts for relay operation, is furnished by rectifier power supplies on the modulator type 50A-10 chassis. There are three power supplies in the modulator: the low-voltage plate and screen supply, the low-voltage bias supply, and the

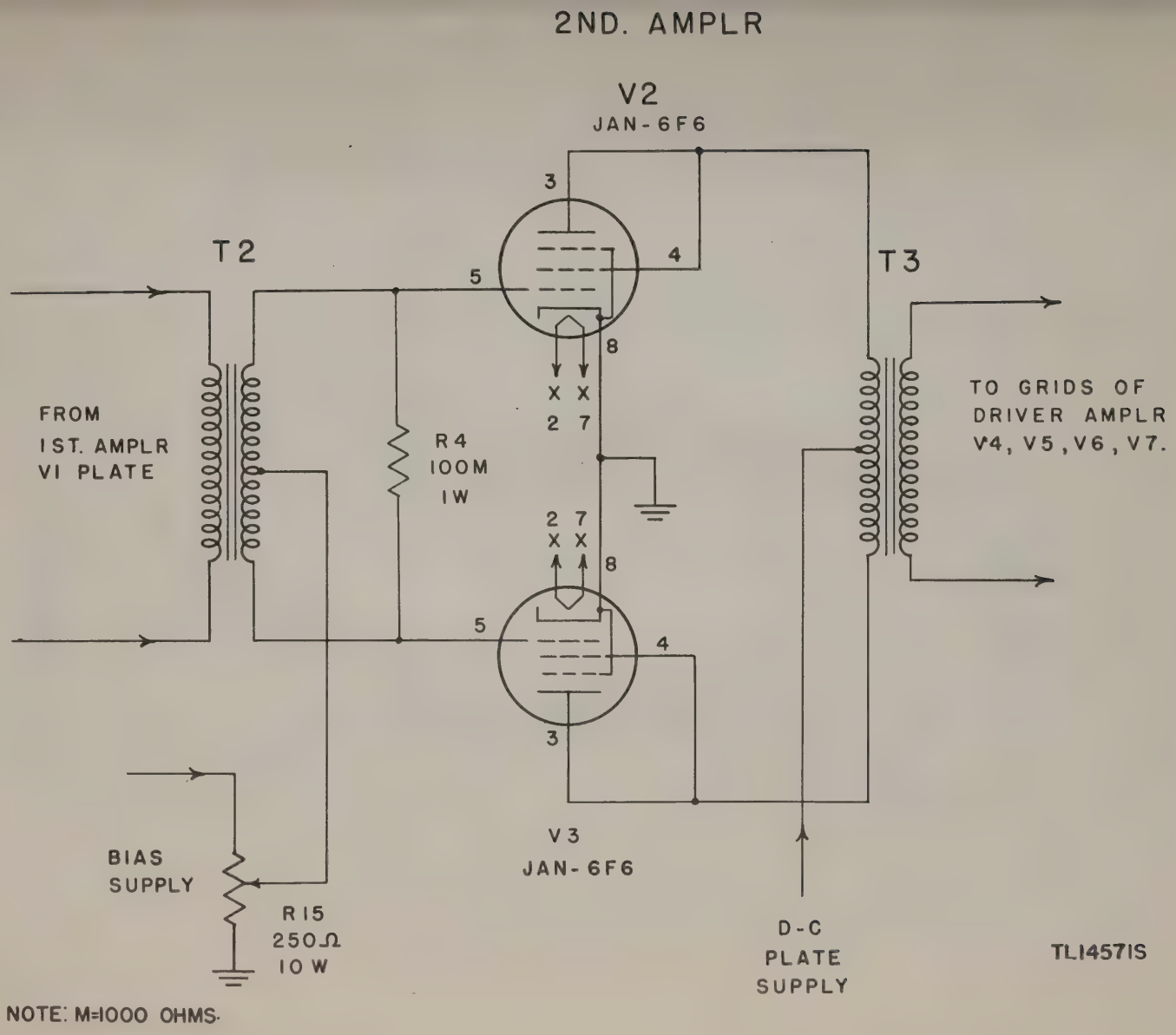


Figure 27. Second amplifier, partial schematic diagram.

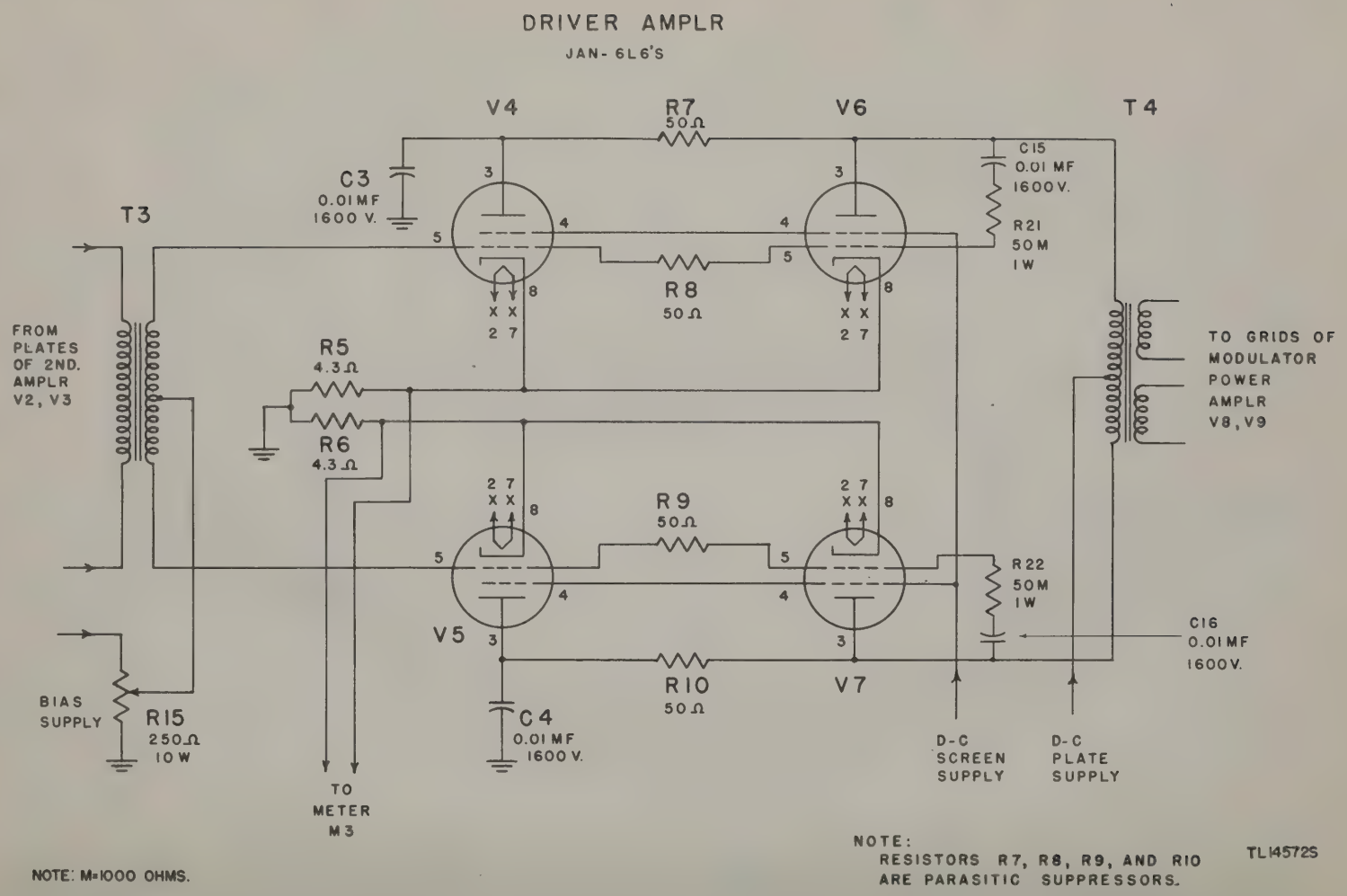


Figure 28. Driver amplifier, partial schematic diagram.

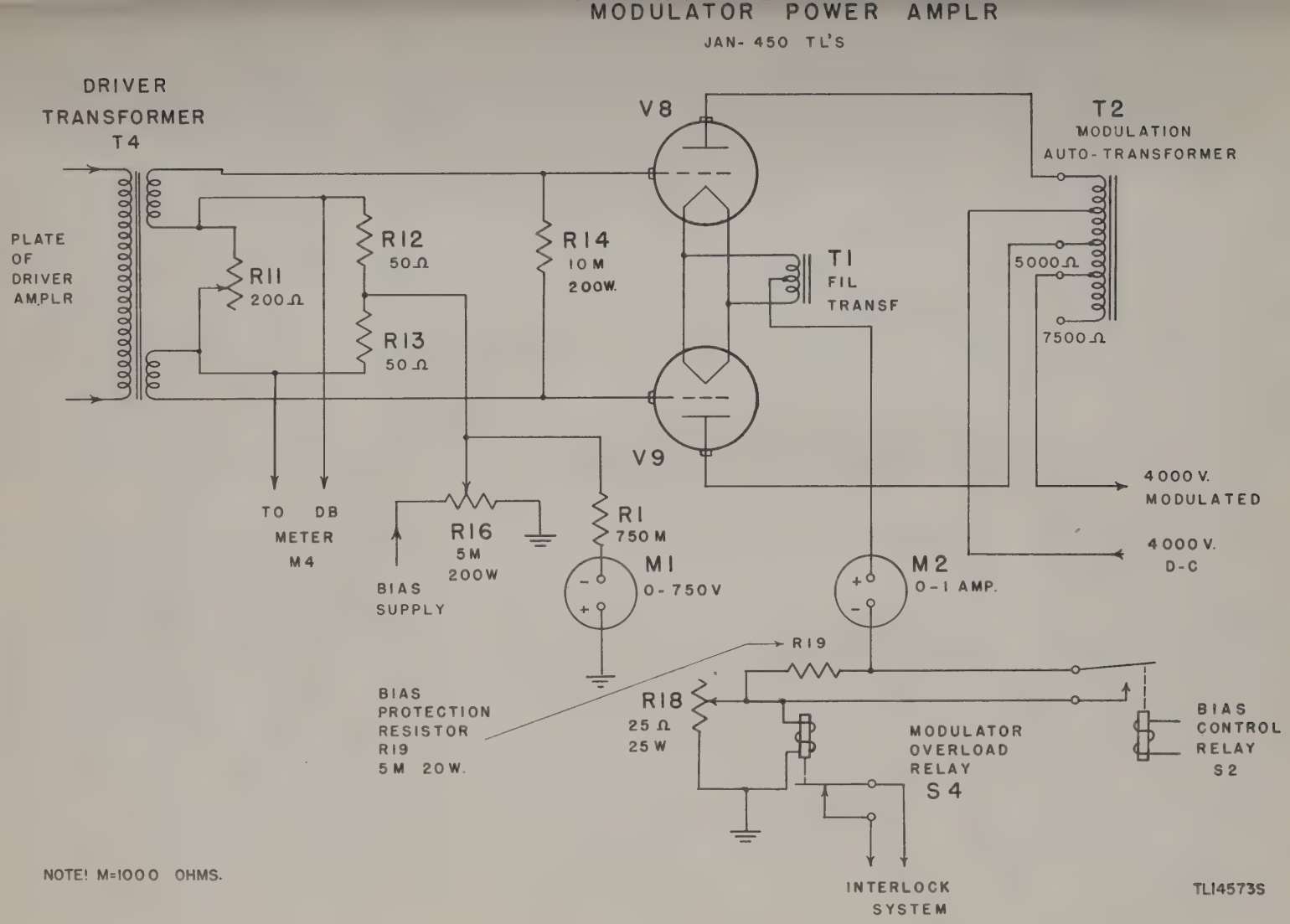


Figure 29. Modulator power amplifier, partial schematic diagram.

modulator power-amplifier bias supply.

b. Low-voltage Plate and Screen Supply. Figure 30 is a partial schematic diagram showing the low-voltage plate and screen supplies. The low-voltage plate and screen supply is a dual power supply with separate filters. The higher voltage output is used for the plate supply of the driver amplifier tubes, V4, V5, V6, and V7. The low-voltage output furnishes d-c screen voltage for the driver amplifier tubes, plate voltage for first amplifier tube VI, and plate voltage for the second amplifier tubes, V2 and V3.

(*1*) *High-voltage Section.* The outside terminals of the high-voltage winding of plate transformer T6 are connected to tubes V11 and V13. The plates of each of these tubes are connected in parallel to give additional current carrying capacity. The circuit is a conventional full-wave, single-phase, rectifier circuit. The rectified output is filtered by the choke-input filter network consisting of choke L3 and capacitors C10, C11, and C12. Resistor R20 is a bleeder resistor to improve the voltage regulation and to keep the voltage from rising too high at light load. The negative side of the filter and the center tap of T6 are grounded to the chassis. Filament heater power is supplied by filament transformer T5. One side of the primary of transformer T6 connects directly to the 220-volt a-c line. The other side connects to the functional control relay S3. See paragraph 60 for a discussion of the operation of this relay.

(*2*) *Low-voltage Section.* Low-voltage taps on transformer T6 are connected to the plates of the dual section rectifier tube V12 in a conventional full-wave, single-phase, rectifier circuit. Filament heater power is supplied by filament transformer T5. The rectifier output is filtered by the choke-input filter consisting of choke L2 and capacitors C7 and C8. The output at this point supplies the d-c plate voltage for tubes V2 and V3, and the d-c screen voltage for tubes V4, V5, V6, and V7. Connected to this point is an additional filtering network consisting of choke L4 and capacitor C9, which provides additional filtering for the d-c plate supply of the first amplifier tube V1. This additional filtering network is used to minimize power supply hum in the output of the modulator.

c. Low-voltage Bias Supply. Figure 30 shows the circuits of the low-voltage bias supply. A low-voltage winding on plate transformer T6 is connected to the plates of rectifier tube V10. Filament heater power is supplied by a winding on filament transformer T5. The center tap of the filament winding is grounded. The center tap of the low-voltage winding on T6, which is the negative side of the rectified output, is connected to the pi-section filter network, capacitor C5, choke L1, and capacitor C6. The adjustable resistor R15 across the output of the filter has a slider to permit adjustment of the bias voltage supplied to tubes V2, V3, V4, V5, V6, and V7.

d. Modulator Power-amplifier Bias Supply. Figure 31 shows the circuits of the modulator power-amplifier bias supply. The bias supply consists of a rectifier and its associated filter, and a bias isolator tube which prevents the flow of grid current in tubes V8 and V9 from affecting the bias supply voltage. Power transformer T7 furnishes all of the necessary voltages for both the rectifier and bias isolator tubes.

(*1*) *Bias Supply.* The high-voltage winding of transformer T7 is connected to the plates of the dual section rectifier tube V14. Filament heater power is supplied from a low-voltage winding on T7. One side of the filament winding is grounded to the chassis. The center tap of the high-voltage winding, which is the negative side of the rectified output, is connected to a choke-input filter section consisting of chokes L5 and L6 and capacitors C13 and C14. Resistor R17 is connected across the output as a bleeder resistor to improve the voltage regulation of the bias supply. The output connects to the bias isolator circuit which is described below.

(*2*) *Bias Isolator.* The bias isolator circuit prevents excessive voltage rise in the bias supply circuit when the grids of tubes V8 and V9 are driven positive and grid current flows. Bias isolator tube V15 is a dual-section rectifier with the plates connected together. Filament heater power is supplied by a winding on transformer T7. The output of the bias supply is connected to the center tap of this filament winding. The plate of V15 is connected to ground through resistor R16. An adjustable tap on R16 connects to the grid circuit of V8 and V3 and to MODULATOR BIAS meter M1. Another tap provides operating voltage for the bias protection relay

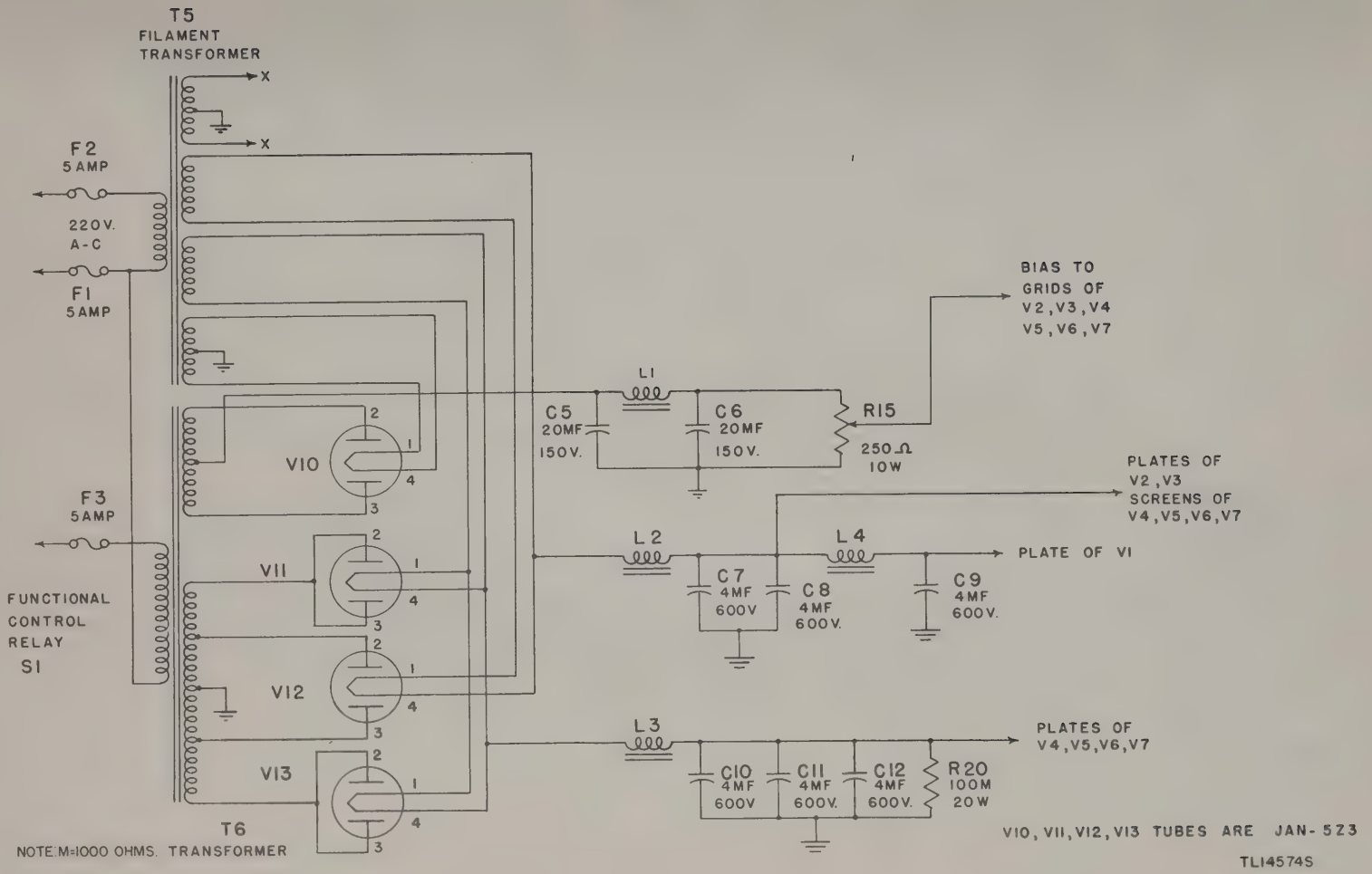


Figure 30. Bias and low-voltage plate supplies, partial schematic diagram.

S3. (See par. 60). When the grids of V8 and V9 are driven positive and grid current flows, the voltage across R16 tends to increase. This increase is voltage across R16 decreases the voltage drop across V15 and increases the plate impedance of the tube, which brings the voltage across R16 to near its original value. Thus the action of bias isolator tube V15 is to hold the grid bias on V8 and V9 nearly constant. This reduces the distortion in the modulator power amplifier.

61. DIALING UNIT TYPE 168C.

a. General. Dialing unit type 168C provides relaying and switching circuits for remotely controlling up to 10 radio transmitters for phone operation. The dialing unit operates in conjunction with auxiliary control relay unit type 169D (par. 60). Figure 32 is a block diagram of the complete modulator relaying system. Figures 33 and 34 are partial schematic diagrams showing the dialing unit circuits. See also figure 44.

b. Dialing. A dial tone from a remotely located control console, or from the local MODULATOR CHANNEL SELECTOR dial S5 is rectified by copper-oxide rectifier D1. The number of pulses received is determined by the number dialed. For instance, if number 3 is dialed, there is a long 60-cycle pulse while the dial is rotated clockwise to the stop. As the dial is released and it turns to its normal position, there are two additional pulses. The total number of pulses, including the initial long pulse, is equal to the number dialed. The rectified direct current from each pulse causes impulse relay S1 to close, once for each pulse. During the first long pulse current flows through the operating coil of the control relay S2 and through contacts on circuit 1 of minor switch S3. Relay S2 closes and the lower contacts on S2 are paralleled with the active contacts on circuit 1 of S3. At the same time, minor switch S3 has been operated by the step coil, causing it to advance one position from its normal off position. The normal off position is the position shown in figure 33. As the contact on minor switch S3 moves from the off position, the contacts of circuit 1 are opened. Succeeding dialing pulses operate the step coil through the lower contacts on control relay S2. Control relay is a slow-release relay and remains closed during the entire dialing operation. See paragraph 59d for additional discussion of relay S2. Minor switch S3 includes three 10-position switches. Circuit 2 connects the underload relay in the transmitter which is dialed to control relay S1 and bias control relay S2 in auxiliary control relay unit type 169D. Circuit 3 connects the modulator release contacts in the transmitter selected to the coil of return relay S4. Circuit 4 connects modulated plate voltage to the transmitter selected. (See par. 59e.)

c. Modulator Release. In the dialing operation the modulator-release contacts in the transmitter are connected to the coil of return relay S4. After the dialing operation the other end of the coil of S4 is connected to +12 volts by contacts on relay S2. The modulator-release contacts are open during the time the transmitter is selected for use. When the transmitter is released by switches at the remote control console, the modulator-release terminals close and ground the modulator-release line to the modulator. This causes return relay S4 to operate, and it in turn operates the release coil on minor switch S3 in the modulator. The release coil returns the minor switch to its normal off position and places it in readiness for the next dialing operation. Return relay S4 is a slow-release relay. Capacitor C1 across the coil gives additional time lag to insure that the minor switch is returned to its normal off position.

d. Control Relay. Control relay S2 is a slow-release relay. The contacts remain closed during the entire dialing operation, opening about 1/10 of a second after the last dialing pulse of a sequence is received. During the dialing operation the control relay contacts perform several functions. The lower contacts connect the contacts of impulse relay S1 to the step coil of minor switch S3. The center contacts ground the secondary of T1 (169D) and the primary of T1 (50A-10), thus keeping the 60-cycle dialing tones from being amplified by the modulator. The upper contacts open the return relay circuit, thus blocking the modulator-release circuit during the dialing operation.

e. Rectifier Control. Figure 34 shows the circuits for control of the rectifiers which supply plate voltage to the modulator. The first five contacts on circuit 4 of minor switch S3 are connected to control relays in rectifier No. 1. The blade of circuit 4 is grounded through contacts on control relay S2. At the same time, the

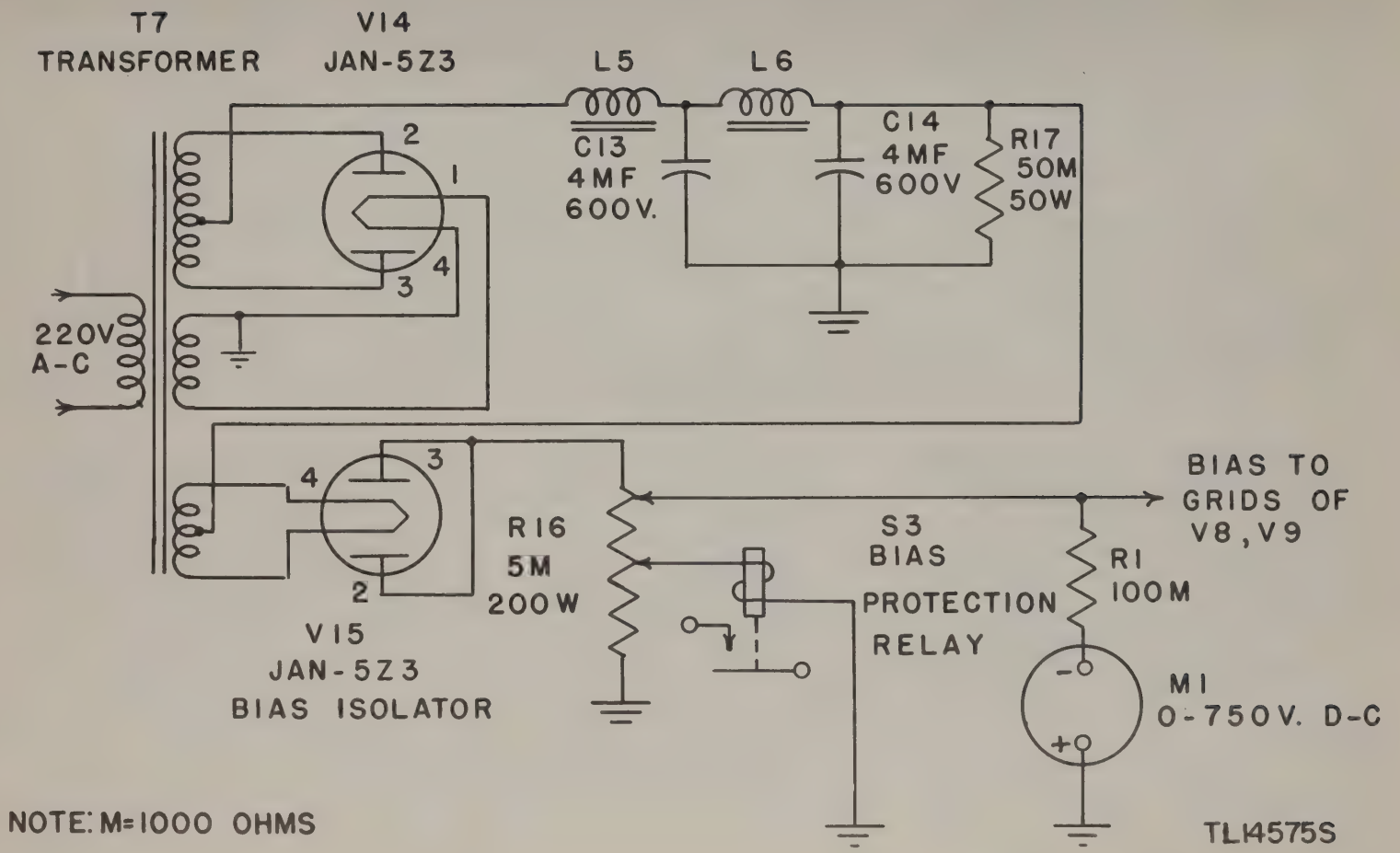


Figure 51. Modulator power-amplifier bias supply, partial schematic diagram.

corresponding operating coil of relay S5 to S9 is grounded, operating its contacts and closing rectifier-selector relay S5 on auxiliary control relay unit type 169D. For example, in figure 34 the blade is on position 2 and relay S6 (168C) is operated, which, in turn closes rectifier-selector relay S5. The contacts of rectifier-selector relay S5 connect 4000 V UNFIL from rectifier No. 1 to the plates of tubes V8 and V9 through a filter circuit. At the same time, a corresponding relay in rectifier No. 1 connects the 4000 V MOD output of the modulator to the transmitter selected. In a similar manner, the second five contacts of circuit 4 of minor switch S3 control rectifier-selector relay S6 through the contacts of relays S10 to S14. Rectifier-selector relay S6 connects 4000 V UNFIL from rectifier No. 2 to tubes V8 and V9.

62. AUXILIARY CONTROL RELAY UNIT TYPE 169D.

a. General. The auxiliary control relay unit chassis centralizes the bias control, bias protection, and modulator overload relay circuits. Also on the chassis are dialing transformer T2, isolation transformer T1, and rectifier-selector relays S5 and S6. The functions of transformers T1 and T2, and relays S5 and S6 are described in paragraphs 53 and 59. Figure 35 is a partial schematic diagram of the bias control, bias protection, and modulator overload circuits. Figure 32 is a block diagram of the relaying system.

b. Functional Control Relay. One side of the coil of functional control relay S1 is connected through contacts on circuit 2 of minor switch S3 in the dialing unit to the underload relay contacts in the transmitter selected for operation. During normal operation of the transmitter, the transmitter underload relay contacts are closed to ground, causing functional control relay S1 to operate. The lower set of contacts of relay S1 applies +12 volts to the coil of the bias control relay S2. The center set of contacts energizes the primary of the plate transformer T6. The upper set of contacts energizes the primary of filament transformer T1, which supplies V8 and V9, when the contacts of the bias protection relay S3 are closed. Relay S1 is a slow-release relay to prevent its opening for momentary underload conditions at the transmitter.

c. Bias Protection and Control. Figures 29, 31, and 35 are partial schematic diagrams showing the bias protection and control and associated circuits. Bias control relay S2 is operated by contacts on functional control relay S1, discussed above. The contacts on bias control relay S2 short-circuit bias protection resistor R19 in the cathode circuit of modulator power-amplifier tubes V8 and V9, and permit V8 and V9 to operate with normal bias. When the contacts of relay S2 open, resistor R19 is returned to the cathode circuit of V8 and V9. The additional bias placed on these tubes as a result of current flow through R19 serves as protection during switching operations and under abnormal operating conditions. Bias protection relay S3 is connected across the modulator power-amplifier bias supply (fig. 31). Upon failure of the bias supply or opening of the contacts of functional control relay S1, the contacts of relay S3 remove filament voltage from tubes V8 and V9. The slider on resistor R16 permits adjustment of the voltage at which the relay operates.

d. Modulator Overload Protection. Figures 29 and 35 show the modulator overload protection circuits. Modulator overload relay S4 is in the cathode circuit of the modulator power-amplifier tubes V8 and V9. The operating coil of relay S4 is shunted by resistor R18 which adjusts the operating point of the relay. The contacts of S4 are in series with the interlock system. When the contacts of S4 are opened because of excessive current in V8 and V9, the high voltage is momentarily removed by the interlock system, permitting relay S4 to close again. Relay S4 continues to recycle until the cause of the overload is removed, or until fuses in the rectifier are blown.

63. METERING CIRCUITS.

a. General. Four meters are provided for indicating the critical currents and voltages of the modulator. Figure 36 is a schematic diagram showing the meter circuits. Figure 8 shows the markings on the control panel for selector switch S1 which switches AUDIO LEVEL meter M4 and DRIVER AMP meter M3.

b. Modulator Bias. MODULATOR BIAS meter M1 indicates the bias voltage applied to the grids of the modulator power-amplifier tubes V8 and V9. The positive terminal of M1 is grounded. The negative terminal connects through the meter multiplier resistor R1 to the

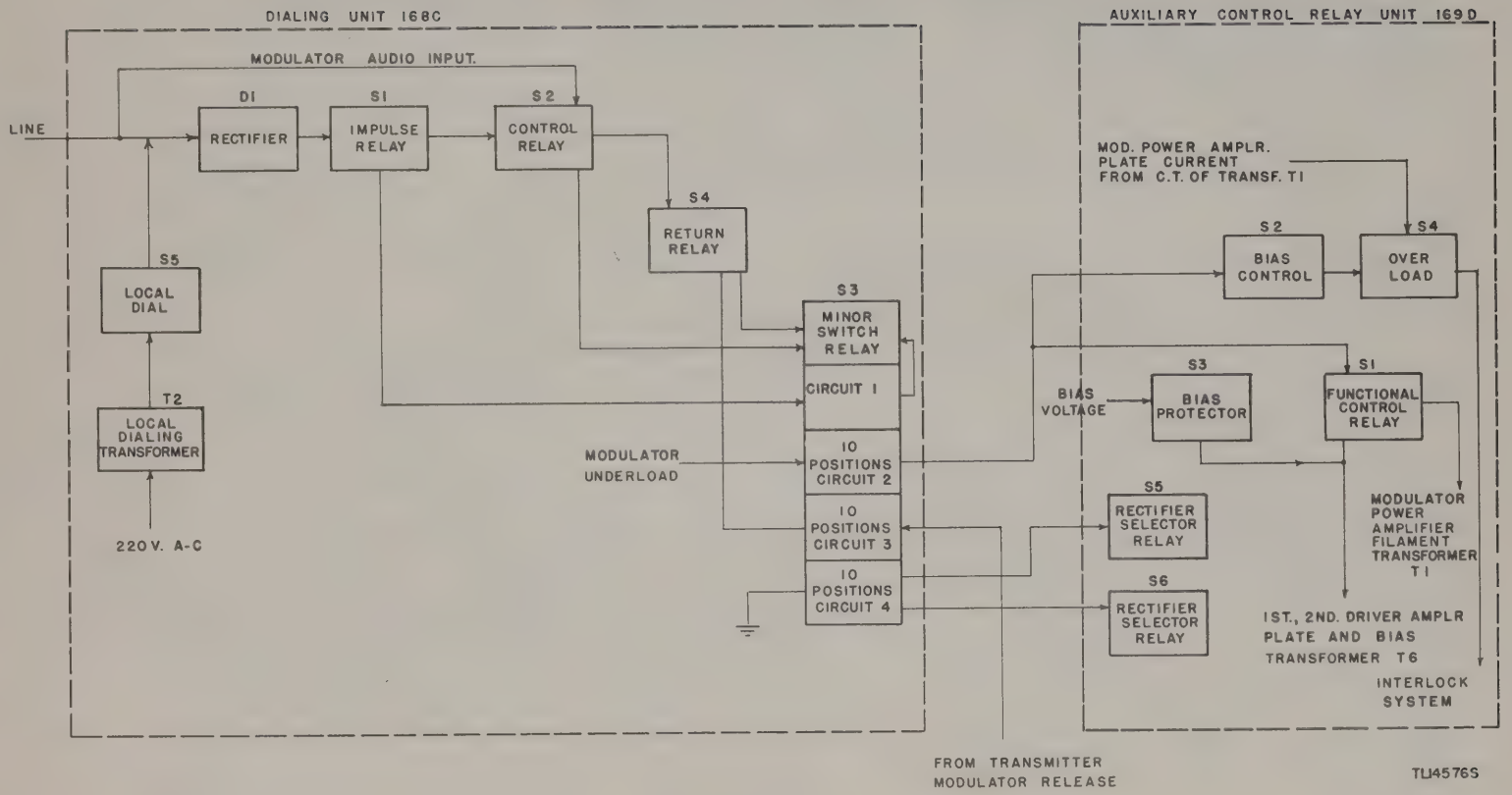


Figure 32. Relaying system, block diagram.

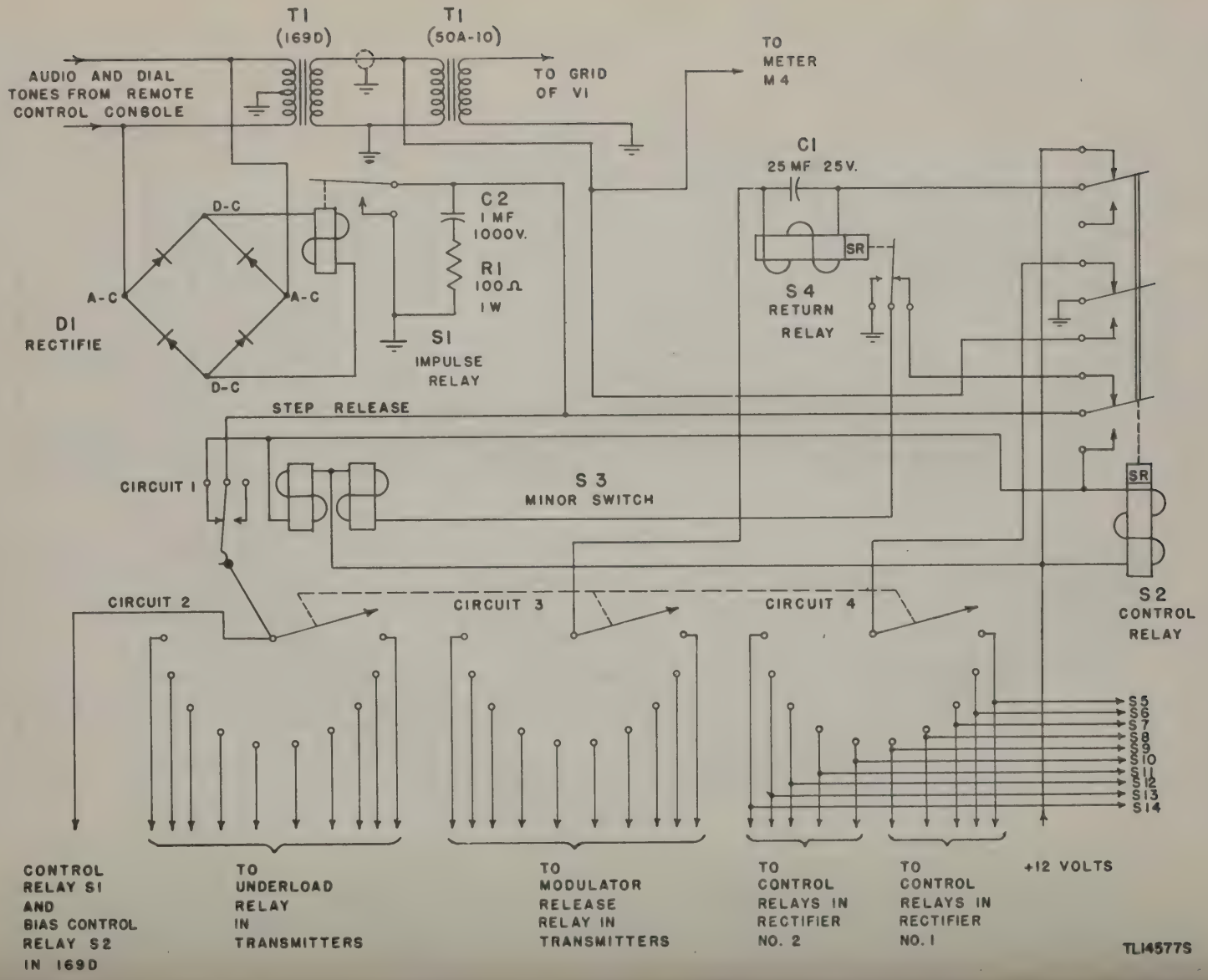


Figure 33. Dialing unit, type 168C, partial schematic diagram.

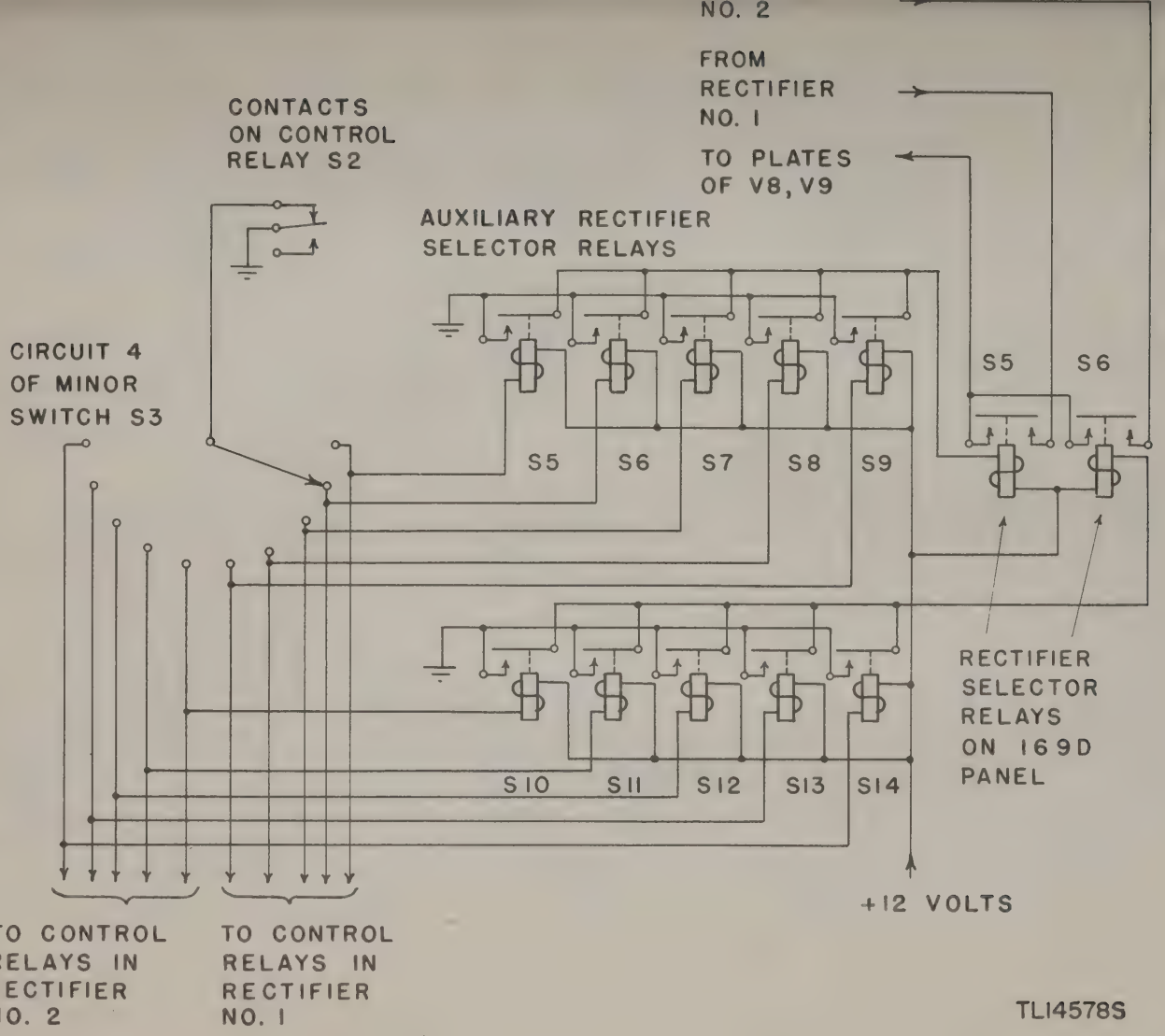


Figure 34. Rectifier control relays, partial schematic diagram.

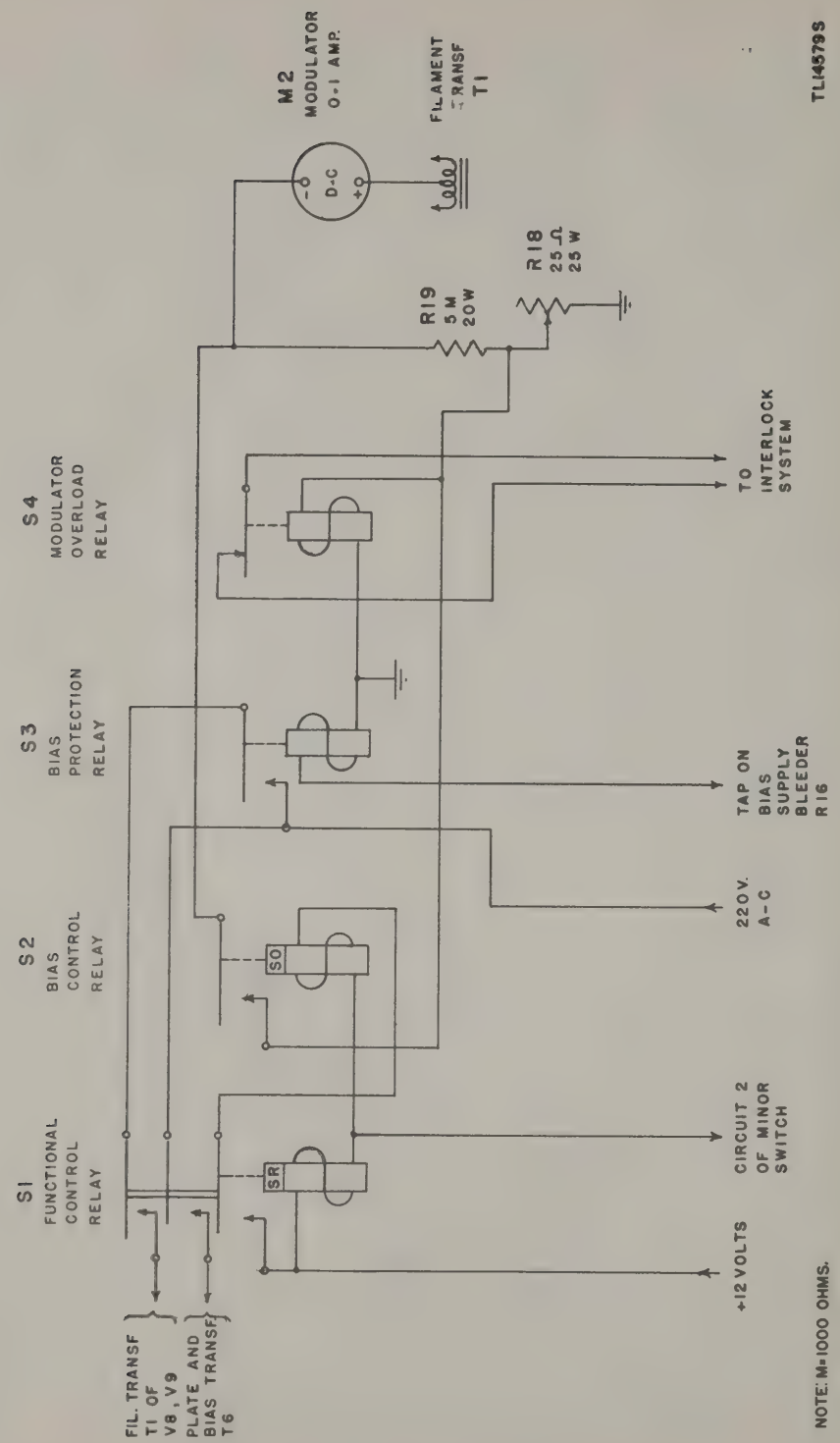


Figure 35. Modulator protection and control relays, partial schematic diagram.

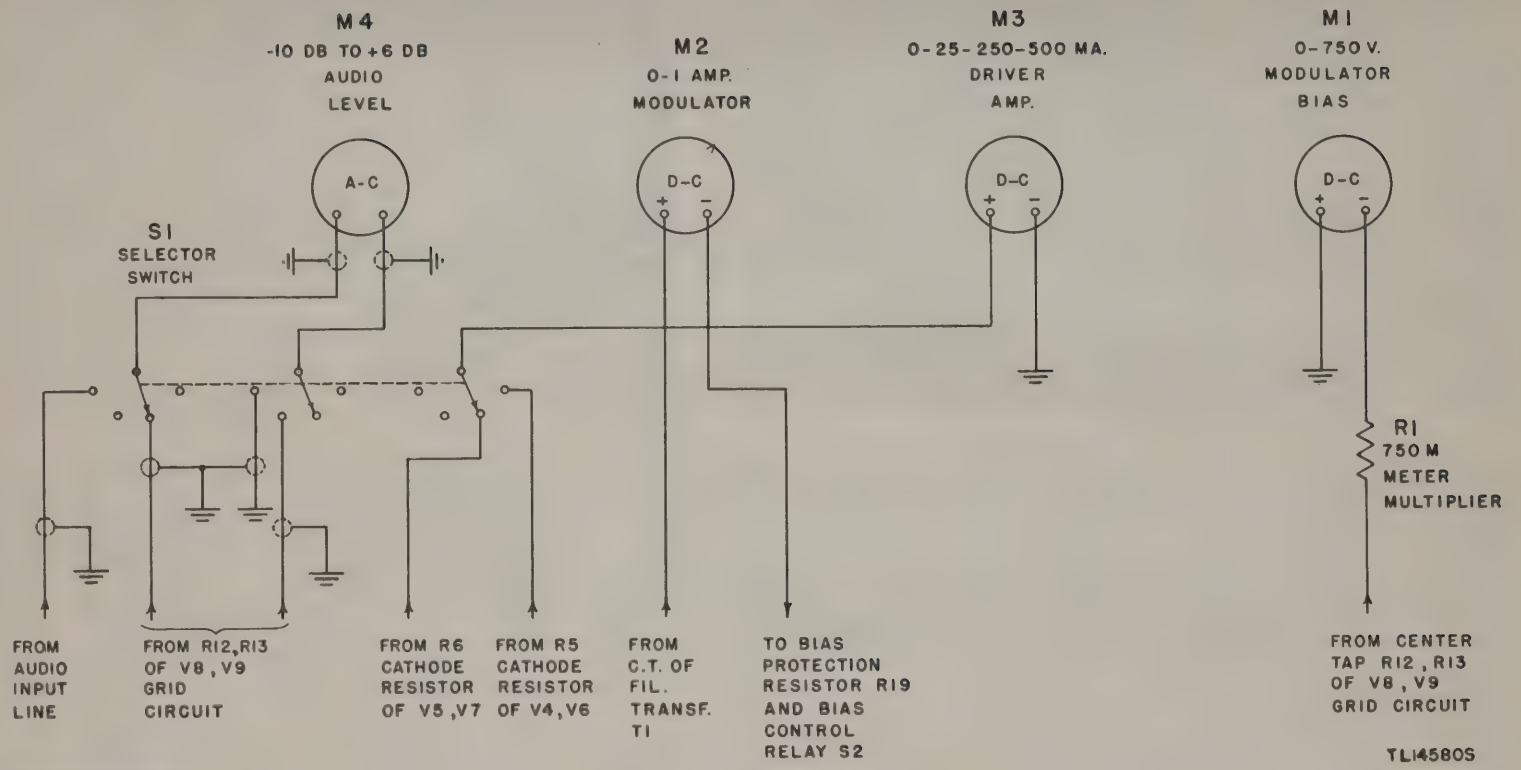


Figure 36. Metering circuits, partial schematic diagram.

center point between resistors R12 and R13 in the grid circuit of the modulator power amplifier. Figure 31 shows the connection to the bias supply.

c. Modulator Plate Current. MODULATOR meter M2 is in the cathode circuit of the modulator power-amplifier tubes V8 and V9 and indicates the total cathode current of this stage. See figures 29 and 36.

d. Driver Amplifier Balance. DRIVER AMP meter M3 is used to indicate the total cathode current in each pair of paralleled tubes in the driver amplifier stage. When selector switch S1 is turned to the 3RD. AMP. A position, meter M3 indicates the cathode current of tubes V5 and V7. In the 3RD. AMP. B position, M3 indicates the cathode current of tubes V4 and V6. See figure 28. Unbalance in the static cathode currents of more than 5 percent between the two pairs of tubes causes excessive distortion. When this condition occurs, new tubes which restore the balance should be installed.

e. Audio Level. AUDIO LEVEL meter M4 is a decibel meter calibrated —10 db to +6 db on a 6-milliwatt base. When selector switch S1 is turned to the AUDIO INPUT position (fig. 8), meter M4 is placed across the primary of the input transformer T1 (50A-10). In this position meter M4 indicates the audio input level from the remote control console. In the AUDIO OUTPUT position, meter M4 is placed across resistor R11 in the grid circuit of the modulator power amplifier (fig. 29). Resistor R11 may be adjusted to give the desired range of readings on meter M4. The indication on the OUTPUT LEVEL position is purely relative.

64. INTERLOCK CIRCUIT.

The interlock circuit protects operating personnel from contact with the high voltages used in the modulator by turning off these high voltages when a door or panel which gives access to high voltage is opened. In addition, the interlock circuit is momentarily opened when an overload occurs in the modulator power amplifier (par. 60d). The interlock circuit consists of interlock switches S2, S3, S4, and the contacts of modulator overload relay S4, all in series with the interlock system of the other transmitter station equipment. Switch S2 opens when the rear panel is removed. Switch S3 is opened when the door giving access to the main terminal board is opened. Switch S4 protects the door opening into the compartment containing modulator type 50A-10 chassis.

SECTION XI. TROUBLE-SHOOTING PROCEDURES

65. GENERAL TROUBLE-SHOOTING INFORMATION.

a. General. No matter how well equipment is designed and manufactured, faults occur in service. When such faults occur, the repairman must locate and correct them as rapidly as possible. This section contains general information to aid personnel engaged in the important duty of trouble shooting.

b. Trouble-shooting Data. Take advantage of the material supplied to help in the location of faults. Consult the following trouble-shooting data when necessary:

(*1*) Block diagram of modulator (fig. 25).

(*2*) Schematic diagram of modulator (fig. 44).

(*3*) Partial block diagrams. These diagrams aid in understanding the operation of various parts of the modulator.

(*4*) Simplified and partial schematic diagrams. These diagrams are particularly useful in trouble shooting, because the repairman can follow the electrical functioning of the circuits more easily than on the regular schematics, thus speeding trouble location.

(*5*) Illustrations of components. Front, rear, and interior views aid in locating and identifying parts.

(*6*) Voltage and resistance data for all socket connections.

(*7*) Resistor color code (fig. 42).

(*8*) Capacitor color code (fig. 43).

(*9*) Pin connections. Pin connections on sockets, plugs, and receptacles are numbered or lettered on the various diagrams.

(*a*) Seen from the bottom, pin connections are numbered in a *clockwise* direction around the sockets. On octal sockets, the first pin clockwise from the keyway is the No. 1 pin.

(*b*) Plugs and receptacles are numbered on the side to which the leads are connected.

66. TROUBLE-SHOOTING STEPS.

a. General. The first step in servicing the

modulator is to sectionalize the fault. Sectionalization means tracing the fault to the *circuit* responsible for the abnormal operation of the modulator. The second step is to localize the fault. Localization means tracing the fault to the defective *part* responsible for the abnormal condition. Some faults such as burned-out resistors, overheated motors, and shorted transformers can be located by sight, smell, and hearing. The majority of faults, however, must be located by checking voltage and resistance.

b. Sectionalization. Careful observation of the performance of the modulator will often sectionalize the fault to a particular component. Additional sectionalization of the fault will be discussed in paragraph 70.

c. Localization. Paragraphs 71, 72 and 73 describe the methods of localizing faults within the individual components. These paragraphs are accompanied by trouble shooting charts which list abnormal symptoms and their probable causes. These charts also give the procedure for determining which of the probable locations of the fault is the exact one. In addition, the voltage and resistance charts show the resistance and voltage at each socket pin connection.

67. VOLTAGE MEASUREMENTS.

a. General. Voltage measurements are an almost indispensable aid because most troubles either *result* from abnormal voltages or *produce* abnormal voltages. Voltage measurements are taken easily, because they are always made between two points in a circuit. The circuit need not be interrupted.

(*1*) Unless otherwise specified, the voltages listed on the voltage charts are measured between the indicated points and ground (chassis) with a 1,000-ohms-per-volt meter.

(*2*) Always begin by setting the voltmeter on the *highest* range so that the voltmeter will not be overloaded. Then, if it is necessary to obtain increased accuracy, set the voltmeter to a lower range.

(*3*) When checking cathode voltage, remember that a reading can be obtained when the cathode resistor is actually open as the resistance of the meter may act as a cathode resistor if a low sensitivity meter is used. Thus, the cathode voltage may be approximately normal only as long as the voltmeter is connected between cathode and ground. Before the cathode voltage is measured, make a resistance check with the power turned off to determine whether the cathode resistor is normal.

b. Precautions Against High Voltage. Certain precautions *must* be followed when measuring voltages above a few hundred volts. High voltages are dangerous and can be fatal. When it is necessary to measure high voltages, observe the following rules:

(*1*) Connect the ground lead to the voltmeter.

(*2*) Place one hand in your pocket. This will eliminate the possibility of making accidental contact with either ground or another part of the circuit, thus causing the electricity to travel from one hand to the other through the body.

(*3*) If the voltage is less than 300 volts, connect the test lead to the hot terminal (which may be either positive or negative with respect to ground).

(*4*) If the voltage is greater than 300 volts, shut off the power, connect the hot lead, step away from the voltmeter, turn on the power, and note the reading on the voltmeter. Do not touch any part of the voltmeter, particularly when it is necessary to measure the voltage between two points which are both above ground.

c. Voltmeter Loading. Voltmeter resistance must be at least 10 times as large as the resistance of the circuit across which the voltage is measured. If the voltmeter resistance is nearly equal to the circuit resistance, the voltmeter will indicate a voltage *lower* than the actual voltage present when the voltmeter is removed from the circuit.

(*1*) The resistance of the voltmeter on any range can always be calculated by the following simple rule: Resistance of the voltmeter equals the ohms-per-volt value multiplied by the full-scale meter range in volts. For example: The resistance of a 1,000 ohm-per-volt meter on the 300-volt range is 300,000 ohms. (R = 1,000 ohms per volt times 300 volts = 300,000 ohms.)

(*2*) To minimize the voltmeter loading in high-resistance circuits, use the highest voltmeter range. Although only a small deflection

will be obtained (possibly only 5 divisions on a 100-division scale) the accuracy of the voltage measurement will be increased. The decreased loading of the voltmeter will more than compensate for the visual inaccuracy which results from reading only a small deflection on the voltmeter scale.

(*3*) When a voltmeter is loading a circuit, the effect can always be noted by comparing the voltage readings on two successive ranges. If the voltage readings do not agree, the loading is excessive. The reading (not the deflection) on the highest range will be greater than that on the lower range. If the voltmeter is loading the circuit heavily, the deflection of the pointer will remain nearly the same when the voltmeter is shifted from one range to the other.

(*4*) The ohm-per-volt sensitivity of the voltmeter used to obtain the readings on the voltage and resistance chart in this manual is printed on the chart. Use a meter having the same ohm-per-volt sensitivity. Otherwise it will be necessary to consider the effect of loading.

68. RESISTANCE MEASUREMENTS.

An ohmmeter is commonly used for resistance measurements in servicing defective equipment. Before a resistance measurement is made, the meter probes must be short-circuited and the zero adjustment made. This adjustment consists merely of turning the zero-adjustment knob or screw so that the meter reads zero ohms when the probes are short-circuited. This adjustment must be repeated for each ohmmeter scale used. The zero adjustment for ohmmeter measurements is not to be confused with the adjustment in the lower center of the meter face which adjusts the position of the pointer to zero before voltage measurements are made.

69. CAPACITOR TESTS.

a. General. It is often necessary to check for leakage or open or short circuits which are caused by puncture of the dielectric between the plates of capacitors of the tinfoil and paper or mica types. This does not apply to wet electrolytic types, since this type is self-healing.

b. Open Capacitors. To check a capacitor for a suspected open circuit, place a good capacitor in parallel with it. In radio-frequency (r-f) circuits keep the leads as short as those of the doubtful capacitor. This precaution is not necessary in audio-frequency (a-f) circuits; the leads may be several inches long. Proper operation of the equipment after the auxiliary capacitor is added indicates that the suspected capacitor is open and should be replaced.

c. Shorted or Leaky Capacitors. To check capacitors suspected of being shorted or leaky, observe the kick indication on an ohmmeter. Before making the check, remove one of the capacitor leads from the circuit so that the circuit will not affect the test. Adjust the ohmmeter to its highest range and connect it across the capacitor. If the capacitor is good, the needle will flick over slightly as the capacitor charges, and then will drop back gradually to infinity. If the ohmmeter needle does not go back to infinity, the capacitor is leaky and should be replaced. The flick of the needle will be small for small capacitors. The test is not reliable for capacitors which are smaller than about 0.05 microfarad (mf). Electrolytic capacitors will normally show a resistance reading, and the above test indicates a defective electrolytic capacitor only when the resistance reading is less than about 1000 ohms.

d. Capacitor Color Code. A capacitor color code is shown in figure 43. This code can be used for checking the capacitor values against the values shown in the circuit diagram, and for replacing defective capacitors.

70. TUBE CHECKING.

a. Purpose. Tubes are the most frequent causes of defective operation. For this reason the first step in trouble shooting within a component is to check and replace any tubes whose failure may account for the observed symptoms, such as abnormal meter readings. Tube checkers are used to test the tube for adequate emission of electrons and for shorted elements.

b. Tube Replacement Check. While tube checkers will indicate tubes with low emission or shorted elements, the results are not always conclusive because the conditions are not the same as those under which the tube operates in the equipment. For this reason, the final test of a tube which has not been shown to be defective by a tube checker is its replacement by a tube known to be good. In many cases this test is easier and quicker than testing the tube with a tube checker.

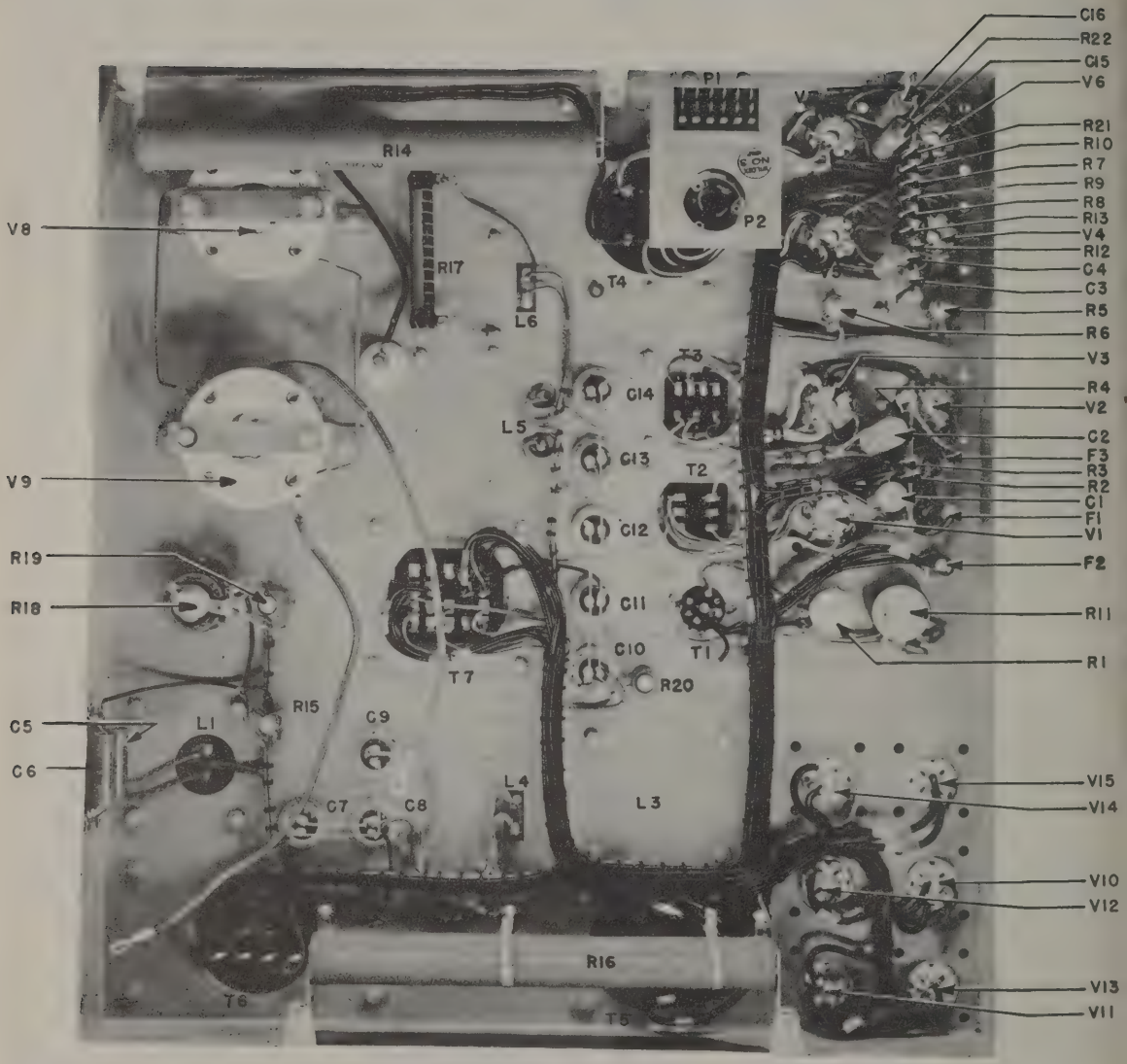
c. Tube Checking Instructions. The operation of various tube checkers is quite different. An instruction manual is provided with each tube checker and should be read to learn how to check a particular tube. Ordinarily charts are given which list the proper connections to make to the tube to be checked, the setting of the tube checker controls, and readings which will be obtained for a good tube.

71. TROUBLE-SHOOTING PROCEDURES.

The accompanying trouble shooting charts, if properly used, simplify trouble-shooting. There are four charts. The first chart covers sectionalization of trouble in the modulator. It lists the symptoms which may be recognized easily by the operator and gives the probable location of the trouble as well as the recommended corrections. The other charts are to be used to localize trouble in the dialing unit, auxiliary relay control unit, and modulator.

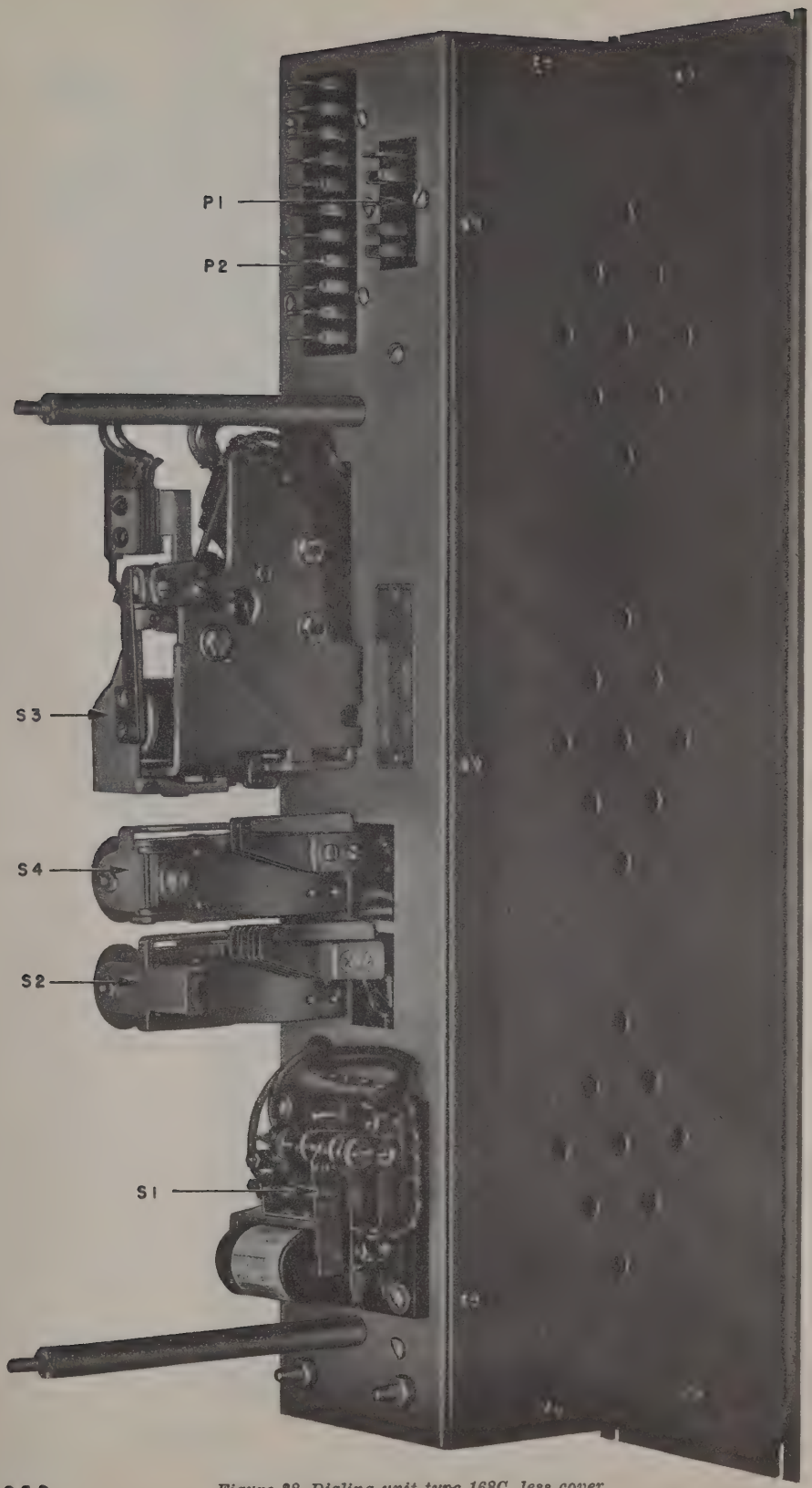
72. SECTIONALIZING TROUBLE IN MODULATOR TYPE 50A3.

SYMPTOMS	PROBABLE TROUBLE	CORRECTIONS
1. MODULATOR BIAS meter M1 indicates low bias.	1. Defective tube V14 or V15. Incorrect adjustment of tap on resistor R16. Defective bias supply.	1. Replace. Adjust. See paragraph 18e. See paragraph 73.
2. MODULATOR meter M2 indicates low current.	2. Defective relay S2. Defective tube V8 or V9. Bias voltage too high.	2. Replace. Replace. Adjust. See paragraph 18e.
3. DRIVER AMP. meter M3 indicates unbalance between two sets of tubes.	3. Defective tube V4, V5, V6, or V7.	3. Replace defective tube and check balance.
4. Meter M4 indicates no AUDIO INPUT.	4. Defective keying line. Defective relay S2. Defective transformer T1 (169D) or T1 (50A-10). Defective selector switch S1.	4. Repair. Replace. Replace. Replace.
5. Meter M4 indicates normal AUDIO INPUT but no AUDIO OUTPUT.	5. Defective modulator. Defective selector switch S1.	5. See paragraph 73. Replace.
6. Excessive distortion.	6. Driver amplifier unbalanced. Wrong tap on modulation transformer T2.	6. See paragraph 73. Adjust to proper tap.
7. Oscillation.	7. Defective modulator.	7. See paragraph 73.
8. Proper transmitter not selected when modulator is dialed.	8. Defective dialing unit.	8. See paragraph 71.
9. Tube V8 and V9 filaments fail to light.	9. Fuse F3 or F4 blown.	9. Replace.
10. Blower motor fails to run.	10. Fuse F1 or F2 blown.	10. Replace.
11. Modulator fails to turn on when selected by remote control console.	11. Defective auxiliary control relay unit. Defective modulator release relay S2 in transmitter.	11. See paragraph 72. See TM 11-2671.
12. MODULATOR CHANNEL SELECTOR dial S5 fails to operate modulator.	12. Fuse F1 blown. Defective dial S2.	12. Replace. Replace.



TL14581S

Figure 37. Modulator type 50A-10, interior view.



TL 14582S

Figure 38. Dialing unit type 168C, less cover.

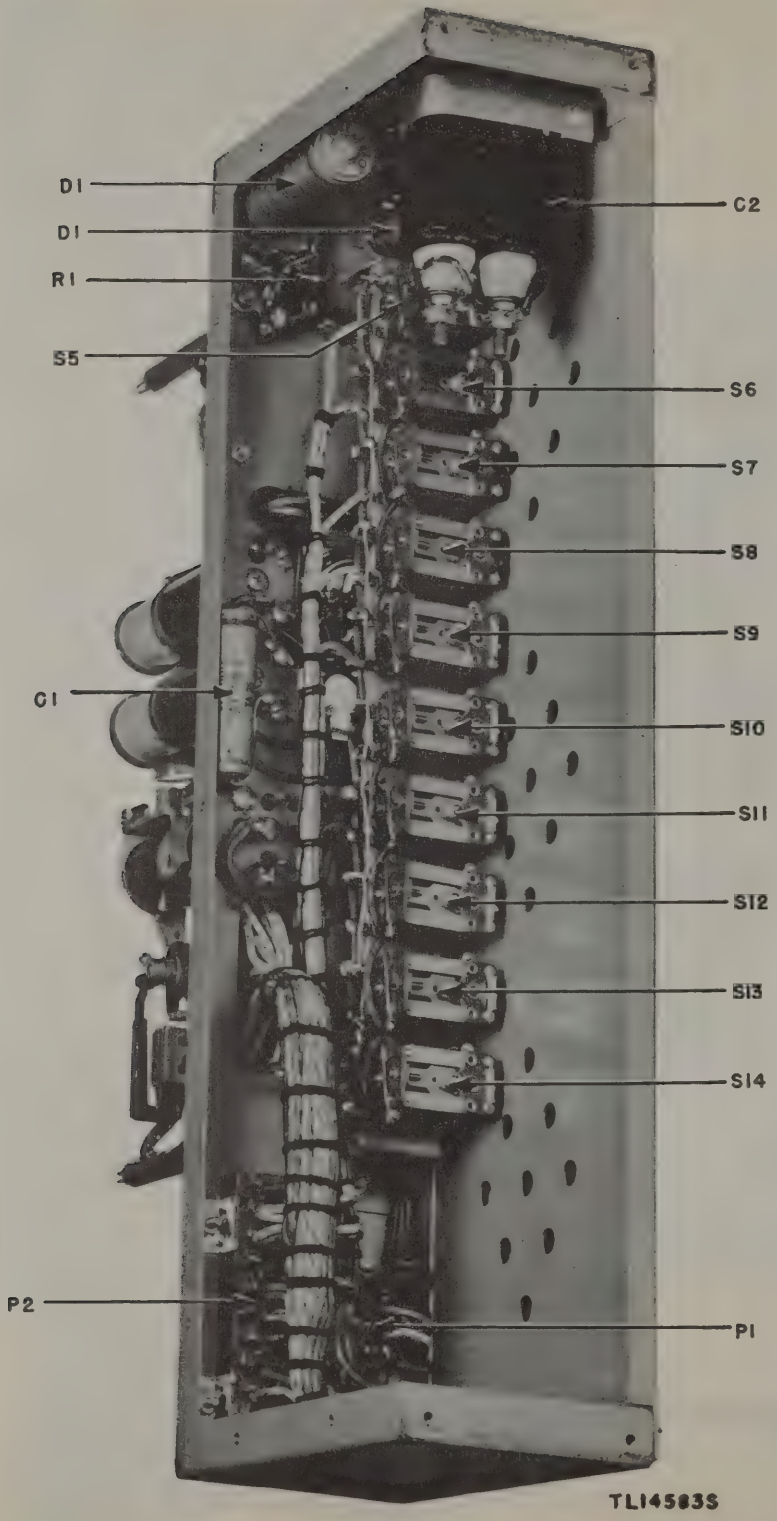


Figure 39. Dialing unit type 168C, interior view.

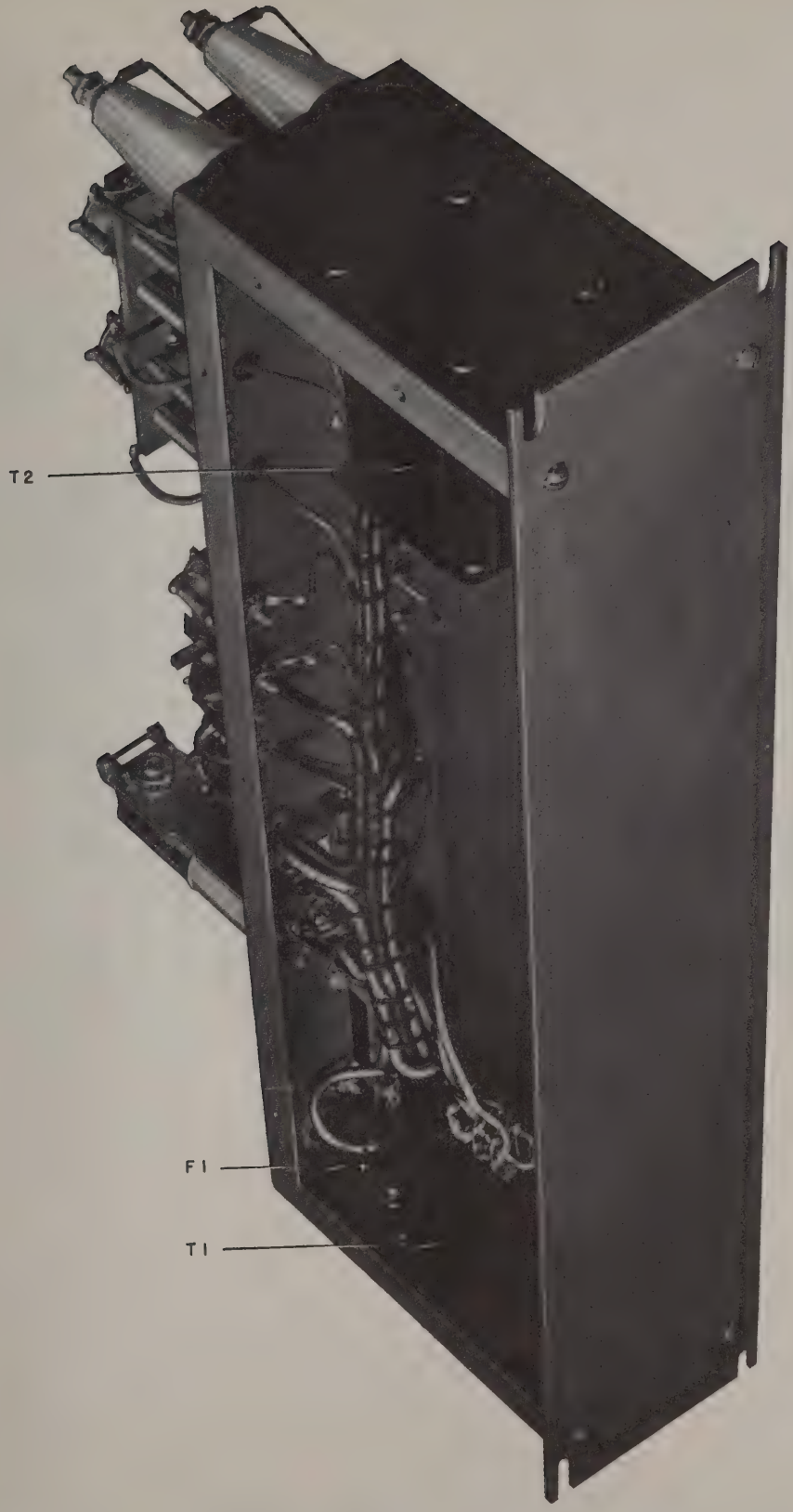


Figure 40. Auxiliary control relay unit type 169D, interior view.

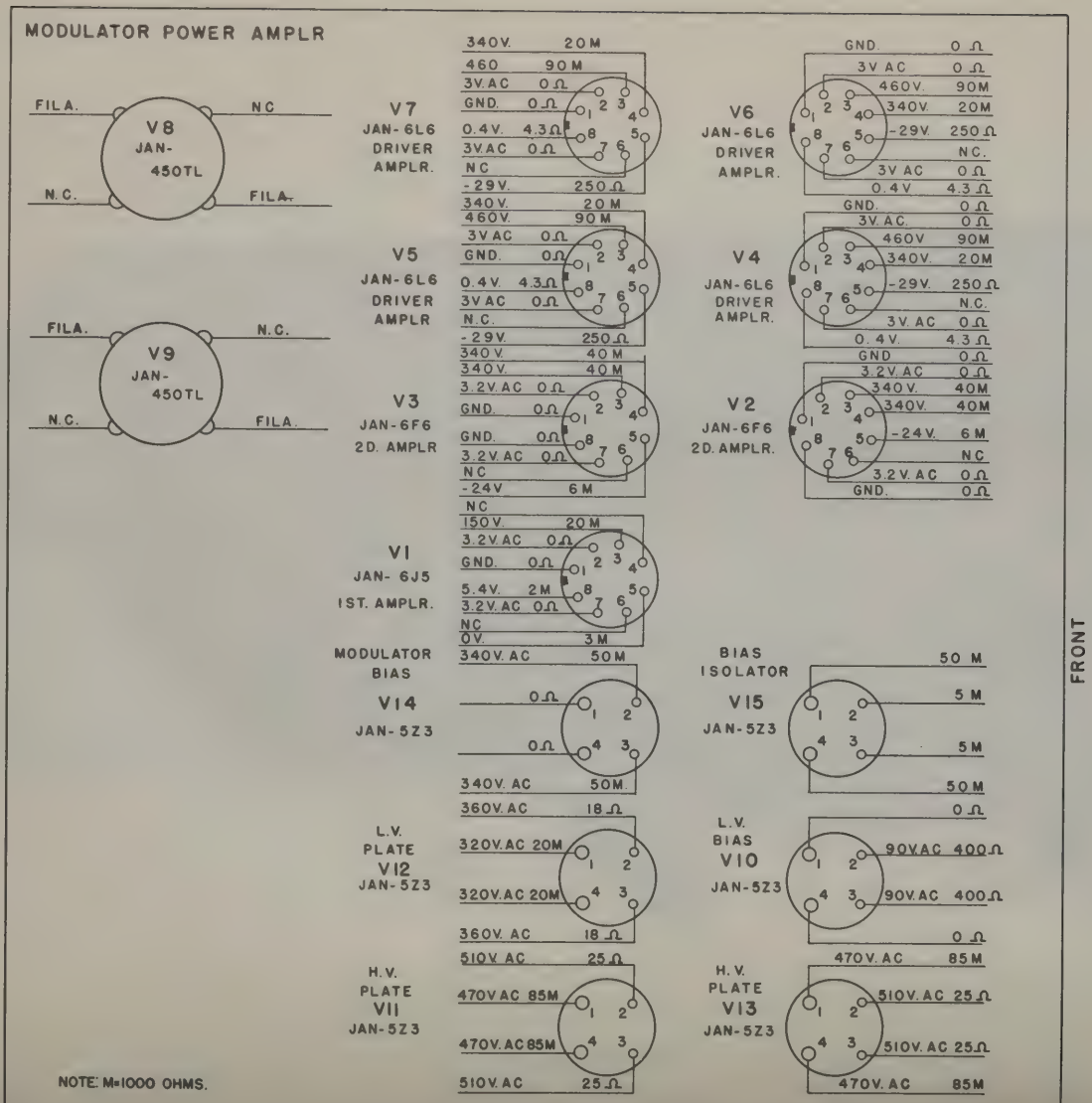


Figure 41. Modulator type 50A-10, voltage and resistance chart.

73. LOCALIZING TROUBLE IN DIALING UNIT (figs. 33, 34, and 44).

SYMPTOMS	PROBABLE TROUBLE	CORRECTIONS
1. Minor switch S3 inoperative.	1. Defective rectifier D1. Defective relay S1. Defective minor switch S3. Defective control relay S2.	1. Replace. Repair or replace. Repair or replace. Repair or replace.
2. Minor switch S3 steps around to proper position but fails to select transmitter.	2. Dirty contacts on switch S3. Transmitter underload relays out of adjustment. Defective relays S5 or S6 in auxiliary control relay unit. Defective relay S2.	2. Clean contacts. See TM 11-2671. See paragraph 72. Repair or replace.
3. Minor switch S3 fails to return to normal off position.	3. Defective switch S3. Defective return relay S4.	3. Repair or replace. Repair or replace.
4. Minor switch S2 operation erratic. Returns to normal off position during transmitter operation.	4. Open capacitor C1.	4. Replace.

74. LOCALIZING TROUBLE IN AUXILIARY CONTROL RELAY UNIT (figs. 34, 35, and 44).

SYMPTOMS	PROBABLE TROUBLE	CORRECTIONS
1. No low-voltage plate or bias supply.	1. Fuse F3(50A-10) blown. Defective functional control relay S1. Defective minor switch S3.	1. Replace. Repair or replace. See paragraph 71.
2. Filaments of tubes V8 and V9 fail to light.	2. Defective relay S1. Voltage tap on R16 incorrectly adjusted. Bias protection relay S3 defective.	2. Repair or replace. Adjust. See paragraph 18e. Repair or replace.
3. Modulator overload relay S4 operates improperly.	3. Resistor R18 improperly adjusted. Resistor R18 defective. Relay S4 defective.	3. Adjust. See paragraph 18d. Replace. Repair or replace.
4. Bias control relay S2 inoperative.	4. Defective relay S2. Defective relay S1.	4. Repair or replace. Repair or replace.
5. No plate voltage on tubes V8 and V9.	5. Defective relay S5 or S6. Defective dialing unit. (See paragraph 73.) No 4,000 volts from rectifier.	5. Repair or replace. See paragraph 71. See TM 11-2666.

75. LOCALIZING TROUBLE IN MODULATOR TYPE 50A-10 (figs. 26, 27, 28, 29, 30, 31, and 44).

SYMPTOMS	PROBABLE TROUBLE	CORRECTIONS
1. AUDIO INPUT normal. No AUDIO OUTPUT.	1. Resistor R1 improperly adjusted. Resistor R1 defective. Transformer T1 defective. Tube V1 defective. Second or driver amplifiers defective.	1. Adjust. See paragraph 18a. Replace. Replace. Replace. See items below.
2. Voltage at pins of V1 normal except:		
a. No voltage at pin 3.	a. Resistor R3 open. Capacitor C9 shorted. Choke L4 open. Defective plate voltage supply.	a. Replace. Replace. Repair or replace. Repair. See item 10.
b. High voltage at pin 8.	b. Shorted capacitor C2.	b. Replace.
3. Voltage at pins of types V2 and V3 normal except:		
a. No voltage at pins 3 and 4.	a. Transformer T3 defective. Plate supply defective.	a. Replace. Repair. Item 10.
b. No bias voltage at pin 5.	b. Incorrect adjustment of resistor R15. Defective bias supply. Shorted resistor R4.	b. Adjust. See paragraph 18b. See item 12. Replace.
4. Voltage at pins of tube V4 normal except:		
a. No voltage at pin 3.	a. Shorted capacitor C3. Open resistor R7. Defective plate supply.	a. Replace. Replace. See item 11.
b. No voltage at pin 4.	b. Defective screen supply.	b. See item 10.
c. No voltage at pin 5.	c. Defective transformer T3. Incorrect adjustment on potentiometer R15. Bias supply defective.	c. Replace. See paragraph 18b. See item 12.
d. No voltage at pin 8.	d. Resistor R5 shorted.	d. Replace.
5. Voltage at pins of tube V5 normal except:		
a. No voltage at pin 3.	a. Shorted capacitor C4. Open resistor R10. Defective plate supply.	a. Replace. Replace. See item 11.
b. No voltage at pin 4.	b. Defective screen supply.	b. See item 10.
c. No voltage at pin 5.	c. See item 4c above.	c. See item 4c.
d. No voltage at pin 8.	d. Resistor R6 shorted.	d. Replace.

75. LOCALIZING TROUBLE IN MODULATOR TYPE 50A-10 (contd).

SYMPTOMS	PROBABLE TROUBLE	CORRECTIONS
6. Voltage at pins of V6 normal except:		
a. No voltage at pin 3.	a. Defective plate supply. Defective transformer T4.	a. See item 11. Replace.
b. No voltage at pin 4.	b. Defective screen supply.	b. See item 10.
c. No voltage at pin 5.	c. Resistor R8 open. See item 4c above.	c. Replace. See item 4c.
d. No voltage at pin 8.	d. Resistor R5 shorted.	d. Replace.
e. Positive voltage at pin 5.	e. Shorted capacitor C15.	e. Replace.
7. Voltages at pins of tube V7 normal except:		
a. No voltage at pin 3.	a. See item 6a above.	a. See item 6a.
b. No voltage at pin 4.	b. Defective screen supply.	b. See item 10.
c. No voltage at pin 5.	c. Resistor R9 open. See item 4c above.	c. Replace. See item 4c.
d. No voltage at pin 8.	d. Resistor R6 shorted.	d. Replace.
e. Positive voltage at pin 5.	e. Shorted capacitor C16.	e. Replace.
8. Oscillation or badly distorted output.	8. Shorted resistor R7, R8, R9 or R10. Shorted capacitor C3 or C4. Shorted or open resistors R21 or R22. Shorted or open capacitor C15 or C16. Defective tube V8 or V9.	8. Replace. Replace. Replace. Replace. Replace.
9. No bias to tubes V8 and V9.	9. Tap on R16 incorrectly adjusted. Resistor R16 open. Resistor R14 shorted. Tube V14 or V15 defective. Transformer T7 defective. Choke L5 or L6 open. Capacitor C13 or C14 shorted. Resistor R17 shorted.	9. Adjust. See paragraph 18e. Replace. Replace. Replace. Replace. Replace. Replace. Replace.
10. Low or no plate voltage to tubes V1, V2, and V3, and no screen voltage to tubes V4, V5, V6, and V7.	10. Fuse F1, F2 or F3 blown. Defective functional control relay S1. Defective transformer T5 or T6. Defective tube V12. Open choke L2. Shorted capacitor C7, C8, or C9.	10. Replace. See paragraph 73. Replace. Replace. Replace. Replace.

75. LOCALIZING TROUBLE IN MODULATOR TYPE 50A-10 (contd).

SYMPTOMS	PROBABLE TROUBLE	CORRECTIONS
11. Low or no plate voltage to tubes V4, V5, V6 and V7.	11. Defective tube V11 or V13. Defective transformer T5 or T6. Fuse F1, F2, or F3 blown. Defective functional control relay S1. Open choke L3. Shorted capacitor C10, C11, or C12. Shorted resistor R20.	11. Replace. Replace. Replace. See paragraph 73. Replace. Replace. Replace.
12. Low or no bias voltage to tubes, V2, V3, V4, V5, V6, and V7.	12. Defective tube V10. Defective transformer V5 or V6. Fuse F1, F2, or F3 blown. Open choke L1. Shorted capacitor C5 or C6. Defective resistor R15. Defective functional control relay S1.	12. Replace. Replace. Replace. Replace. Replace. Replace. See paragraph 73.
13. Excessive hum in output.	13. Choke L4 shorted. Capacitor C9 open. Ground on input line shield open. See items 10, 11, and 12. Choke L1 shorted. Capacitor C1 open.	13. Replace. Replace. Repair. Replace. Replace.
14. Excessive heating of plates of tubes V8 and V9.	14. D-c plate voltage too high. Insufficient bias. Excessive input. See item 8.	14. Check at rectifier and adjust. Adjust. See paragraph 18e. Adjust R1. See paragraph 18a. See item 8.

SECTION XII. REPAIRS

76. REPLACEMENT OF PARTS.

Careless replacement of parts often makes new faults inevitable. Note the following points.

a. Before removing a part, note the position of its leads. Place tags on each lead to insure that it is returned to its proper place.

b. Be careful, not to damage other leads or parts by carelessly pushing them out of the way. It may, however, be necessary to remove parts to make room for replacing the defective part.

c. Do not allow drops of solder to fall into the chassis since they may cause short circuits.

d. Use care in making a soldered joint. A poorly soldered joint is very difficult to find. The proper method is to heat the parts to be soldered with the soldering iron until solder will flow over them freely, thus forming a good electrical connection. Do not use too much solder. Do not move the part until the solder has set.

77. RUSTPROOFING AND REPAINTING.

When the finish on the case has been badly scarred or damaged, rust and corrosion can be prevented by touching up the bared surface as follows:

a. Use #00 or #000 sandpaper to clean the surface down to the bare metal. Obtain a bright smooth finish.

CAUTION: The use of steel wool, although permitting rapid removal of rust, is not recommended. Minute particles of steel wool frequently enter the case and cause harmful internal shorting or grounding of the circuits.

b. When a touch-up job is necessary, apply paint with a small brush. When numerous scars and scratches warrant complete repainting, remove the modulator chassis and spray paint over the entire case. Remove rust from the case by cleaning corroded metal with dry-cleaning solvent (SD). In severe cases it may be necessary to use dry-cleaning solvent (SD) to soften the rust and sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

78. UNSATISFACTORY EQUIPMENT REPORT.

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, War Department Unsatisfactory Report, W.D., A.G.O. Form No. 468 should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D.C.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form No. 54 should be filled out and forwarded through channels.

APPENDIX

SECTION XIII. REFERENCES

NOTE: For availability of items listed, check FM 21-6 and ASF Catalog SIG 2. Also see FM 21-6 for applicable technical bulletins, supply bulletins, modification work orders, and Changes.

79. ARMY REGULATIONS.

AR 380-5	Safeguarding Military Information.

80. SUPPLY PUBLICATIONS.

SIG 1	Introduction to ASF Signal Supply Catalog.
SIG 3	List of Items for Troop Issue.
SIG 4-1	Allowances of Expendable Supplies.
SIG 4-2	Allowances of Expendable Supplies for Schools, Training Centers, and Boards.
SIG 5	Stock List of All Items.
SIG 6	Sets of Equipment.
SIG 10	Fixed Plant Maintenance Lists.
SB 11-8	Chests for Running Spares.
SB 11-10	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.
SB 11-17	Electron Tube Supply Data.

81. TECHNICAL MANUALS ON AUXILIARY EQUIPMENT AND TEST EQUIPMENT.

TM 11-303	Test Set I-56.
TM 11-472	Repair and Calibration of Electrical and Measuring Instruments.
TM 11-802	Radio Transmitters (Wilcox-Electric Types 96-200A, 96-200B, and 96-200C).
TM 11-853	Radio Receiver Bay (Wilcox Electric Type 113A).
TM 11-2622	Remote Control Console CY-161/FRC.
TM 11-2627	Tube Tester I-177.
TM 11-2666	Rectifiers (Wilcox Electric Types 36A and 36A4.)
TM 11-2671	Radio Transmitters (Wilcox Electric Types 96A, 96C, and 96C3).

82. PAINTING, PRESERVING, AND LUBRICATION.

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.

83. CAMOUFLAGE.

FM 5-20	Camouflage, Basic Principles.

84. SHIPPING INSTRUCTIONS.

U.S. Army Spec. No. 100-14A	Army-Navy General Specification for Packaging and Packing for Overseas Shipment.

85. DECONTAMINATION.

TM 3-220	Decontamination.

86. DEMOLITION.

FM 5-25	Explosives and Demolitions.

87. OTHER PUBLICATIONS.

FM 24-18	Radio Communication.
TB SIG 5	Defense Against Radio Jamming.
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Ground Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TM 1-455	Electrical Fundamentals.
TM 11-453	Shop Work.
TM 11-455	Radio Fundamentals [if applicable]
TM 11-483	Suppression of Radio Noises.
TM 11-486	Electrical Communication Systems Engineering.
TM 11-4000	Trouble Shooting and Repair of Radio Equipment.
TM 37-250	Basic Maintenance Manual.

88. FORMS.

W.D., A.G.O. Form No. 468 (Unsatisfactory Equipment Report).

Army Air Forces Form No. 54 (Unsatisfctory Report).

89. ABBREVIATIONS.

a-c	alternating-current
a-f	audio-frequency
amp	ampere
db	decibel
d-c	direct-current
mf	microfarad
r-f	radio-frequency
v	volt

90. GLOSSARY.

Refer to the glossary in TM 11-455.

SECTION XIV. MAINTENANCE PARTS

91. ASF SIGNAL SUPPLY PAMPHLET REFERENCE.

The following information was compiled on 14 August 1945. The appropriate pamphlet of the ASF Signal Supply Catalog for modulator type 50A is:

SIG 10-22, Radio Transmitter 96-C, Fixed Plant Maintenance List. For an index of available catalog pamphlets, see the latest issue of ASF Signal Supply Catalog SIG 2.

92. MODULATORS TYPES 50A AND 50A3.

NOTE: Refer to paragraph 91.

REF SYMBOL	SIGNAL CORPS STOCK NO.	NAME OF PART AND DESCRIPTION	MFR'S PART AND CODE NO.
N1	3H392-1	BLOWER: 210/230 v; 60 cps; 1,750 rpm (includes motor and housing).	120A (W9)
C1	3DB2.200	CAPACITOR: paper; oil; 2 mf; 6,000 vdcw	60WA200 (I8)
L1	3C369-9	COIL, filter choke; 6 hy @ 3 amp	S-10764 (K3)
	6Z3856-10	FILTER, air: 10" x 10" x 2"	(04)
F1.2	3Z2606	FUSE, cartridge: renewable; 6 amp, 250 v	1006 (B9)
F3.4	3Z1901-3	FUSE, cartridge: renewable; 3 amp, 250 v	1003 (B9)
	3G1000-16.5	INSULATOR: conical; 2" h x 1⅛", ⅝" diam, tapped 10-32	503 (J4)
M1	3F8750-4	METER: DC; 0-750 v	RX35 (W4)
M2	3F1001-37	METER: DC; 0-1 amp	RX35 (W4)
M3	3F950-39	METER: DC; multiscale; 0/25/250/500 ma	RX35 (W4)
M4	3F3307.13	METER, audio level: –10 to +6 db	RX35 (W4)
R1	3Z6775-11	RESISTOR: carbon; 0.75 meg; 4 w	MVG2219 (I2)
R2	3Z6740-9	RESISTOR: WW; 400,000 ohm; 50 w	A50N (C10)
R2	3Z6700-147	RESISTOR: WW; 100,000 ohm; 50 w (four 100,000-ohm resistors used for R2 in some units).	0422 (02)
R2	3Z6720-26	RESISTOR: WW; 200,000 ohm; 200 w (two 200,000-ohm resistors used for R2 in some units).	200C (C10)
S1	3Z9827.7-3	SWITCH, rotary: 2-gang, 4 ckt, 5 position, nonshorting	1325L (M1)
S2, 3, 4	3Z9811-7	SWITCH, interlock: male section	ML7460330 G4 (G3)
S2, 3, 4	3Z9903E-5	SWITCH, interlock: female section	7760014-2 (G3)
S5	4B794.4-6	SWITCH, tp dial: 11 point	Z5906 (A8)
T1	2Z9975-27	TRANSFORMER: fil; pri 210 to 240 v in 5-v steps; secd tapped 5, 7½, 10, 11 v CT, 380 v.	S10768 (C8)
T2	2Z9634.15	TRANSFORMER: modulation; pri 12,000 ohm; impedance CT; secd 5,000/7,500 ohm.	S10765 (C8)

93. MODULATOR TYPE 50A-10.

NOTE: Refer to paragraph 91.

REF SYMBOL	SIGNAL CORPS STOCK NO.	NAME OF PART AND DESCRIPTION	MFR'S PART AND CODE NO.
C1	3DB25-11	CAPACITOR, electrolytic: 25 mf; 25 vdcw	M-025 (S5)
C2	3DA250-24.1	CAPACITOR, paper: 0.25 mf; 600 vdcw	S-0257 (S5)
C3, 4	3DA10-81.1	CAPACITOR, paper: 0.01 mf; 1,600 vdcw	S-0105 (S5)
C5, 6	3DB20-13.1	CAPACITOR, electrolytic: 20 mf; 150 vdcw	M220 (S5)
C7 to 14 incl	3DB4-83	CAPACITOR, paper: oil; 4 mf; 600 vdcw	C1E5070 (I8)
L1	3C316-35	COIL, filter choke: 15 hy @ 150 ma; 200 ohm DC resistance.	T47945 (T4)
L2, 5	3C316-37	COIL, filter choke: 5 hy @ 200 ma; 80 ohm DC resistance	T45946 (T4)
L3	3C316-38	COIL, filter choke: 5-20 hy @ 300 ma; 105 ohm DC resistance	T19C36 (T4)
L4, 6	3C316-36	COIL, filter choke: 22 hy @ 35 ma; 405 ohm DC resistance	T45952 (T4)
F1, 2, 3	3Z2605.2	FUSE, cartridge: 5 amp; 250 v	1358 (L3)
P1	2Z7228	PLUG: 18 cont	P318AB (J5)
P2	6Z7813-2	RECEPTACLE: 3 cont	7556 (H3)
R1	2Z7271-5	RESISTOR, pot: 0.1 meg	H2672 (C10)
R2	3RC31BF202J	RESISTOR: carbon; 2,000 ohm; 1 w	RC31BF202J
R3	3RC31BF513J	RESISTOR: carbon; 50,000 ohm; 1 w	RC31BF513J
R4	3RC31BF104K	RESISTOR: carbon; 0.1 meg; 1 w	RC31BF104K
R5, 6	3Z5994-11	RESISTOR: WW; 4.3 ohm; 1 w	WW4 (I2)
R7, 8, 9, 10, 11, 12, 13	3RC31BE510J	RESISTOR: carbon; 50 ohm; 1 w	RC31BE510J
R11	2Z7278-13	RESISTOR, pot: 200 ohm	V-123 (C4)
R14	3Z6610-123	RESISTOR: WW; 10,000 ohm; 200 w	A200W (C10)
R15	3Z6025-46	RESISTOR: WW; 250 ohm; 10 w	A10FA (C10)
R16	3Z6500-137	RESISTOR: WW; 5,000 ohm; 200 w	A200WA (C10)
R17	3Z6650-35	RESISTOR: WW; 50,000 ohm; 50 w	A50N (C10)
R18	3Z7025-4	RESISTOR, rheostat: 25 ohm; 25 w	H-0147 (02)
R19	3Z6500-74	RESISTOR: WW; 5,000 ohm; 20 w	A20J (C10)
R20	3Z6700-3	RESISTOR: WW; 100,000 ohm; 20 w	A20J (C10)
	2Z8762.1	SOCKET, tube: 4 cont; steatite	RSS-4 (A13)
	2Z8759.3	SOCKET, tube: 4 cont; 50 w	211-S (J4)
	2C4529/S1	SOCKET, tube: octal; ceramic	CIR-8 (N1)
T1	2Z9631.55	TRANSFORMER: input, pri 500, 333, 250, 200, 125, 50 ohm; secd 50,000 ohm, max level 20 db.	P202 (K3)
T2	2Z9635.6	TRANSFORMER: interstage; single 6J5 to PP 6F6 grids	T45901 (T4)
T3	2Z9633.9	TRANSFORMER: interstage driver; PP 6F6 to PP parallel 6L6.	T45947 (T4)
T4	2Z9633.8	TRANSFORMER: driver; 4 6L6 to PP class B 450 TL	S10766 (K3)
T5	2Z9606-2	TRANSFORMER: fil; pri, 115, 230 v, 60 cps; secd #1 5 v CT @2 amp; secd #2 5 v @ 3 amp; secd #3 5 v @ 6 amp; secd #4 6.3 v CT at 6.1 amp.	T45944 (T4)
T6	2Z9607-2	TRANSFORMER, plate: pri 115, 230 v, 60 cps, secd #1 980 v CT @ 200 to 480 ma, secd # 2 750 v CT @ 104 to 160 ma, secd # 3 190 v CT @ 115 ma.	T45943 (T4)

93. MODULATOR TYPE 50A-10 (contd).

NOTE: Refer to paragraph 91.

REF SYMBOL	SIGNAL CORPS STOCK NO.	NAME OF PART AND DESCRIPTION	MFR'S PART AND CODE NO.
T7	2Z9602-1	TRANSFORMER, power: pri 230 v 50/60 cps, secd #1 680 v CT @ 135 ma, secd #2 77 v bias top, secd #3 5 v @ 3 amp, secd #4 6.3 v at 4 amp, secd #5 6.3 v CT @ 2 amp.	40605-A (T4)
V1	2J6J5	TUBE: type 6J5.	JAN6J5 (R2)
V2, 3	2J6F6	TUBE: type 6F6.	JAN6F6 (R2)
V4, 5, 6, 7	2J6L6	TUBE: type 6L6.	JAN6L6
V8, 9	2J450TL	TUBE: type 450TL.	450TL (E2)
V10, 11, 12, 13, 14, 15	2J5Z3	TUBE: type 5Z3.	JAN5Z3

94. DIALING UNIT TYPE 168C.

NOTE: Refer to paragraph 91.

REF SYMBOL	SIGNAL CORPS STOCK NO.	NAME OF PART AND DESCRIPTION	MFR'S PART AND CODE NO.
C1	3DB25-11	CAPACITOR, electrolytic: 25 mf; 25 vdcw.	M-025 (S5)
C2	3DB1.10010	CAPACITOR: paper; oil; 1 mf; 1,000 vdcw.	TJU-10010 (C15)
P1	2Z7140-1	PLUG: 33 cont; chassis mtg.	P310AB (J5)
D1	3H4839-1	RECTIFIER: copper oxide; input 119/138 v AC; output 87 v DC at 21 ma.	846-058A (W4)
S1	2Z7585-7	RELAY, keying: spot; 12 v dc; 300 ohm coil.	223C34 (K5)
S2	2Z7588-21	RELAY: DPDT; 12 v dc; 200 ohm coil. CONTACTS: for B12649 relay.	B12649 (C9) (C9)
S3	2Z7591-3	RELAY: minor sw; 3 pole; 10 position; 2 coils 12 v dc. CONTACT ASSEMBLY: for Z-8246 relay.	Z-8246 (A8)
S4	2Z7591-4	RELAY: 3PDT; 12 v dc; 200 ohm coil. CONTACTS: for D-12649 relay.	D-12649 (C9)
S5 to 14 incl	2Z7585-9	RELAY: SPST; 12 v dc; 400 ohm coil. CONTACTS: for 1601 relay.	1601 (A28)
R1	3RC31BE101M	RESISTOR: carbon; 100 ohm; 1 w.	RC31BE101M

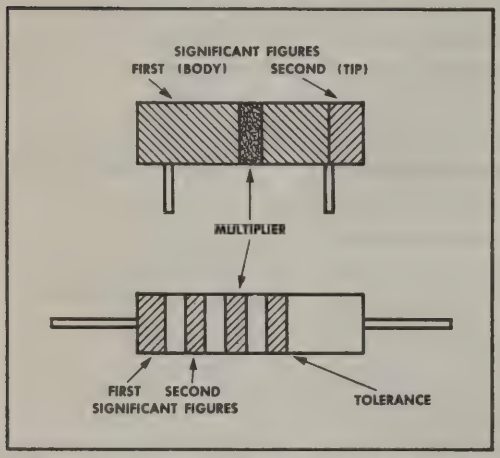
95. AUXILIARY CONTROL RELAY UNIT TYPE 169D.

NOTE: Refer to paragraph 91.

REF SYMBOL	SIGNAL CORPS STOCK NO.	NAME OF PART AND DESCRIPTION	MFR'S PART AND CODE NO.
F1	3Z1926	FUSE: 1 amp, 250 v, type 3AG.	1040 (B9)
P1	2Z7140-1	PLUG: 33 cont; chassis mtg.	P333AB (J5)
S1	2Z7585-12	RELAY: SPDT; 12 v dc coil; 1 form C contacts and 2 micro sw. CONTACTS: for Z9696 relay.	Z9696 (A8) (A8)
S2	2Z7587-14	RELAY: 12 v dc; 500 ohm coil. CONTACTS: for E-12649 relay.	E-12649 (C9) (C9)
S3	2Z7589-14	RELAY: SPST; 12 v dc; 500 ohm coil.	1024 (L2)
S4	2Z7636	RELAY: SPST; 12 v dc; 95 ohm coil.	1015 (L2)
S5, 6	2Z9725	RELAY: SPST; 12 v dc; 67 ohm coil.	1601-SMX (L2)
T1	2Z9975-31	TRANSFORMER: line isolation; 1:1 ratio; 50, 125, 200, 250, 333, 500 ohm impedance.	T26 (K3)
T2	2Z9635.5	TRANSFORMER: dialing voltage.	T102 (K3)

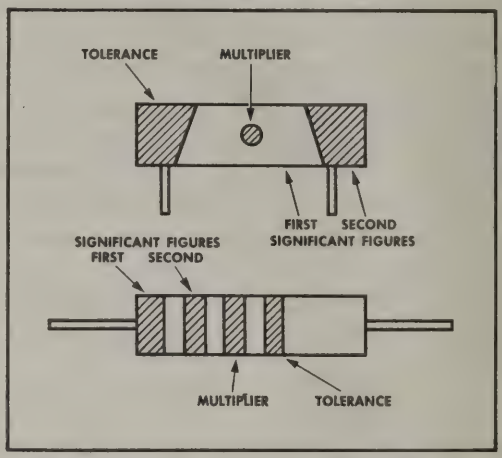
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS



Resistors with axial leads are insulated. Resistors with radial leads are uninsulated.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000*	
GRAY	8	100,000,000*	
WHITE	9	1,000,000,000*	
GOLD		0.1*	5
SILVER		0.01*	10
NO COLOR			20

*JAN ONLY

Example: A 50,000-ohm resistor with a standard tolerance of 20 percent (no color) would be indicated by a green ring (5), a black ring (0), and an orange ring (000)

RMA: Radio Manufacturers Association
JAN: Joint Army-Navy

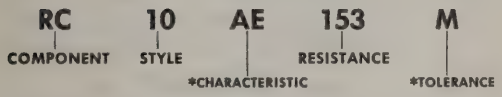
TL 13418 A

JOINT ARMY-NAVY TYPE DESIGNATION CODES FOR ELECTRICAL COMPONENTS

INTRODUCTION: Fixed and variable resistors and fixed capacitors manufactured under JAN specifications may be labeled with a *type designation code* instead of a color code or actual electrical value. For resistors and capacitors marked with the JAN type designation code, electrical values and other data can be determined by consulting the following information.

RESISTORS

FIXED, COMPOSITION



COMPONENT: RC signifies *fixed, composition resistor.*

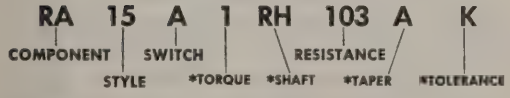
STYLE: A two-digit symbol indicates power rating and physical size.

Resistor style	Wattage
RC10, RC15, RC16	¼ WATT
RC20, RC21, RC25	½ WATT
RC30, RC31, RC35, RC38	1 WATT
RC40, RC41, RC45	2 WATTS
RC65	4 WATTS
RC75, RC76	5 WATTS

RESISTANCE: A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the third digit gives the number of zeros which follow the first two figures.

RESISTORS

VARIABLE, WIRE-WOUND



COMPONENT: RA signifies *variable, wire-wound resistor.*

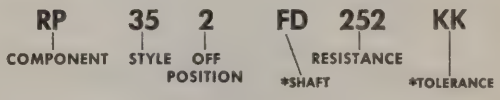
STYLE: A two-digit symbol indicates power rating and physical size and shape.

SWITCH: Symbol A indicates no switch. Symbol B indicates a switch turned ON at start of clockwise rotation.

RESISTANCE: A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the final digit gives the number of zeros which follow the first two figures. The letter *R* may be substituted to represent a decimal point; but when *R* is used, the last digit of the group becomes significant.

RHEOSTATS

WIRE-WOUND, POWER-TYPE



COMPONENT: RP signifies all *rheostats.*

STYLE: Same as for variable, wire-wound resistors.

OFF POSITION:

Numeral	OFF position
1	None.
2	At end of counterclockwise rotation.
3	At end of clockwise rotation.

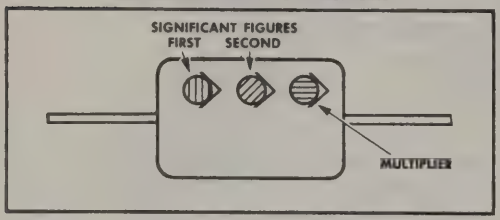
RESISTANCE: Same as for variable, wire-wound resistors.

*Items starred are of interest primarily to depot and higher echelon repair personnel.

TL 18141

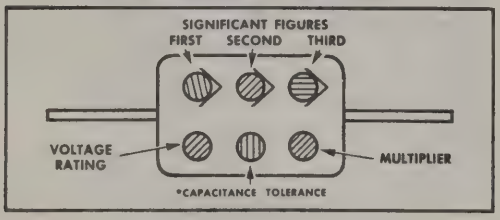
CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

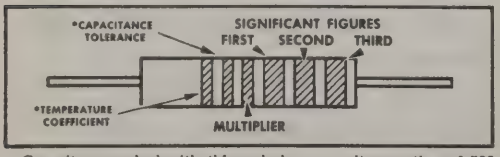


Capacitors marked with this code have a voltage rating of 500 volts.

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



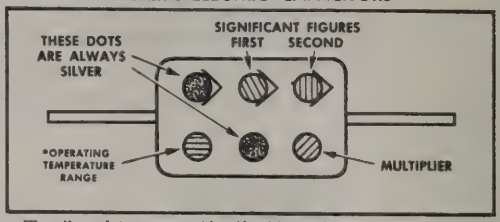
Capacitors marked with this code have a voltage rating of 500 volts.

RMA Radio Manufacturers Association JAN Joint Army-Navy

Note These color codes give all capacitances in micromicrofarads.

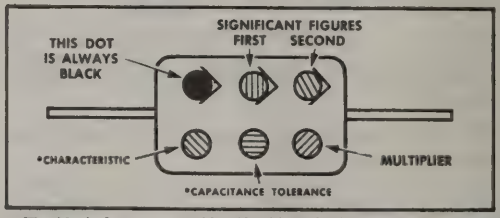
*Items marked with an asterisk are of interest primarily to depot and higher echelon repair personnel

JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



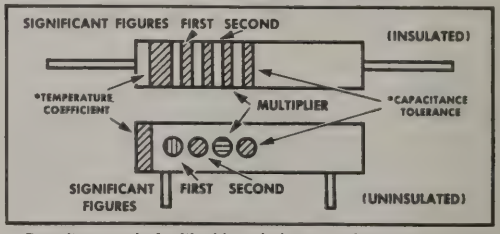
The silver dots serve to identify this marking. For working voltages see JAN type designation code.

JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



The black dot serves to identify this code. For working voltages see JAN type designation code.

JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS



Capacitors marked with this code have a voltage rating of 500 volts. Either the band or dot code may be used.

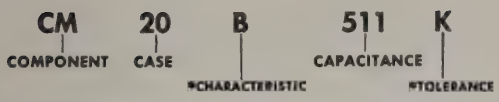
COLOR	SIGNIFICANT FIGURE	MULTIPLIER			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000			400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD		0.1	0.1		1,000
SILVER		0.01	0.01		2,000
NO COLOR					500

TL 13417 A

Figure 43a Capacitor color code.

CAPACITORS

FIXED, MICA-DIELECTRIC



COMPONENT: CM signifies *fixed, mica-dielectric capacitor.*

CASE: A two-digit symbol identifies a physical case size and shape.

CAPACITANCE: A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value; the final digit gives the number of zeros which follow the first two figures. When more than two significant figures are required, additional digits may be used, the last digit always indicating the number of zeros.

D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance range	Vdcw
CM20	5-510 mmf	500
CM25	5-1,000 mmf	500
CM30	470-3,300 mmf	500
CM35	470-6,200 mmf	500
	6,800-10,000 mmf	500
CM40	3,300-8,200 mmf	500
	9,100-10,000 mmf	300

NOTE: Working voltages for capacitors above CM40 are stamped on the case.

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

CAPACITORS

FIXED, MOLDED, PAPER-DIELECTRIC†

COMPONENT: CN signifies *fixed, molded, paper-dielectric capacitor.*

CASE: Same as for fixed, mica-dielectric capacitors.

CAPACITANCE: A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value; the third digit gives the number of zeros which follow the first two figures.

D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance	Vdcw
CN35	3,000 mmf	800
	6,000 mmf	600
	10,000 mmf	400
CN36	3,000 mmf	400
	6,000 mmf	400
	10,000 mmf	300
CN40	3,000 mmf	400
	6,000 mmf	300
	10,000 mmf	300
CN41	3,000 mmf	600
	6,000 mmf	600
	10,000 mmf	400

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

CAPACITORS

FIXED, CERAMIC-DIELECTRIC

COMPONENT: CC signifies *fixed, ceramic-dielectric capacitor.*

CASE: Same as for fixed, mica-dielectric capacitors.

CAPACITANCE: Same as for fixed, molded, paper-dielectric capacitors.

NOTE: All fixed, ceramic-dielectric capacitors have a working voltage of 500 volts, d-c.

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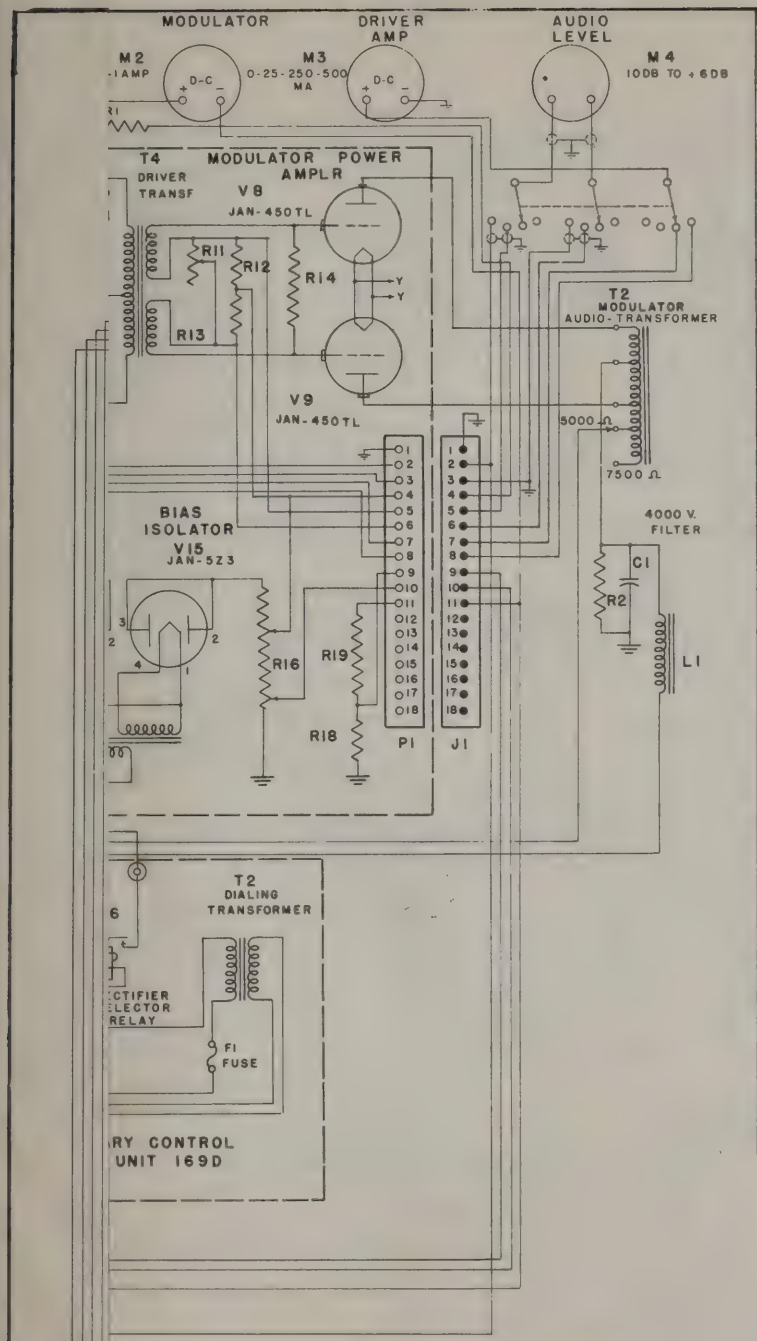
*Items starred are of interest primarily to depot and higher echelon repair personnel.

†This is not a JAN specification. These capacitors are covered by AWS C75/221.

TL 18142

Figure 43 b. Capacitor color code.

☆U.S. GOVERNMENT PRINTING OFFICE : 1951 O - 942750

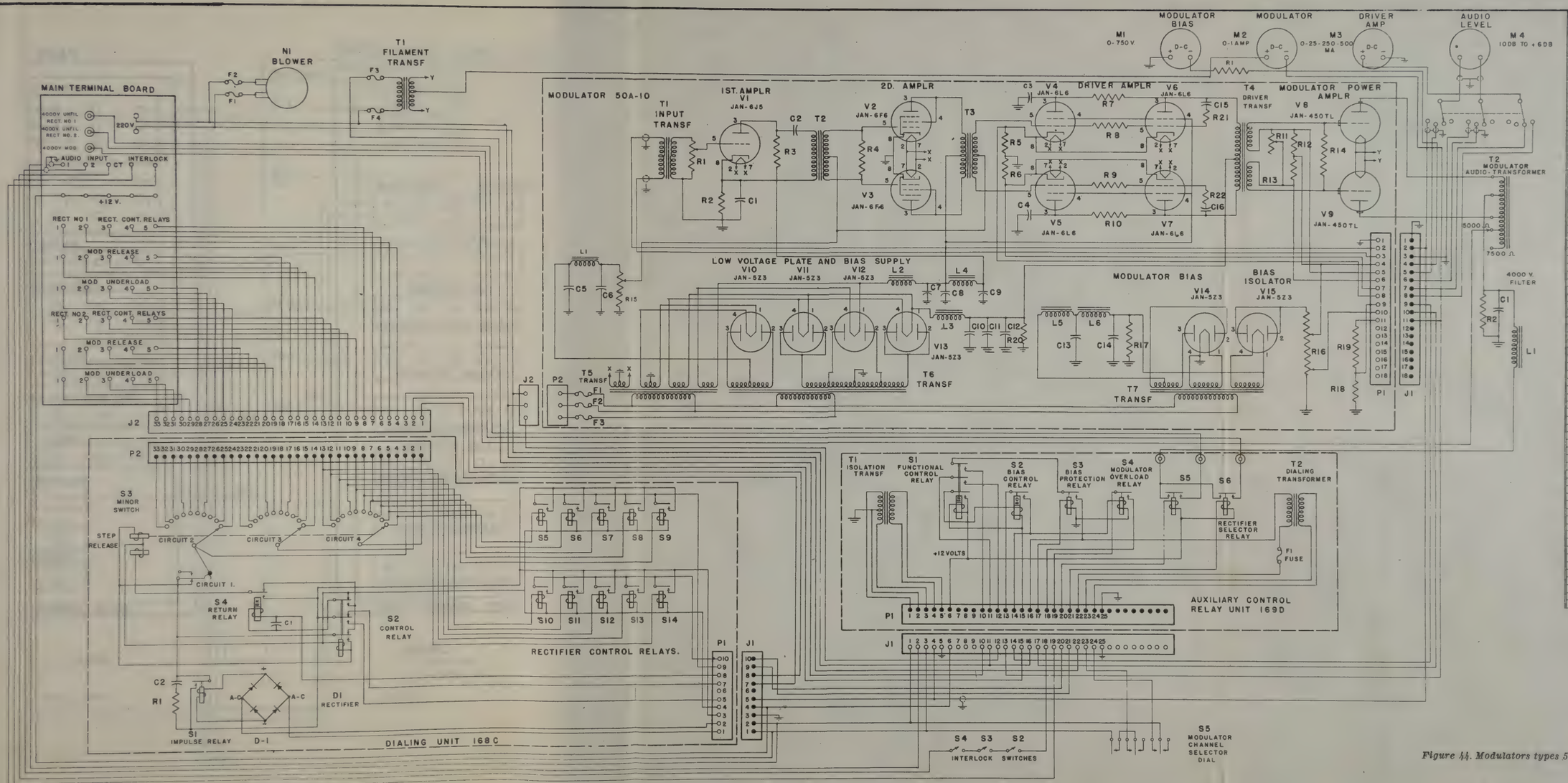


PARTS LIST		
NO.	VALUE	
	50A-10 MODULATOR	
R21	50 M OHMS	1 W.
R22	50 "	1 W.
T1	P202	
T2	T45901	
T3	T45947	
T4	S10766	
T5	T45944	
T6	T45943	
T7	T40605-A	
V1	JAN-6J5	
V2	JAN-6F6	
V3	JAN-6F6	
V4	JAN-6L6	
V5	JAN-6L6	
V6	JAN-6L6	
V7	JAN-6L6	
V8	JAN-450TL	
V9	JAN-450TL	
V10	JAN-5Z3	
V11	JAN-5Z3	
V12	JAN-5Z3	
V13	JAN-5Z3	
V14	JAN-5Z3	
V15	JAN-5Z3	
CONTROL RELAY UNIT 169D		
F1	1 AMP.	
J1	S333AB	
P1	P333AB	
S1	29696	
S2	E12649	
S3	1024	
S4	1015	
S5	1601SMX	
S6	1601SMX	
T1	T26	
T2	T102	
DIALING UNIT 168C		
C1	25MF	25V.
C2	1MF	1000V
D1	S-80605-8A	
J1	S310AB	
J2	S333AB	
P1	P310AB	
P2	P333AB	
R1	100 OHM	1W.
S1	223C34	
S2	B12649	
S3	Z8246	
S4	D12649	
S5	1601	
S6	1601	
S7	1601	
S8	1601	
S9	1601	
S10	1601	
S11	1601	
S12	1601	
S13	1601	
S14	1601	

PARTS LIST		
NO.	VALUE	
	50A3 GENERAL	
C1	2 MF	6000V
F1	6 AMP.	
F2	6 "	
F3	3 "	
F4	3 "	
L1	10764	
M1	0-750V. D-C	
M2	0-1 AMP. D-C	
M3	0-25-250-500 MA D-C	
M4	DB METER -10 TO +6 DB	
N1	BLOWER 120A.	
R1	750 M OHMS	
R2	400 M "	
S1	1325L	
S2	3592	
S3	3592	
S4	3592	
S5	Z5096	
T1	S10768	
T2	S10765	
50A-10 MODULATOR.		
C1	25 MF	25 V.
C2	0.25 MF	600 V.
C3	0.01 "	1 600 V.
C4	0.01 "	1 600 V.
C5	20 "	150 V.
C6	20 "	150 V.
C7	4 "	600 V.
C8	4 "	600 V.
C9	4 "	600 V.
C10	4 "	600 V.
C11	4 "	600 V.
C12	4 "	600 V.
C13	4 "	600 V.
C14	4 "	600 V.
C15	0.01 "	1 600 V.
C16	0.01 "	1 600 V.
F1	5 AMP	250 V.
F2	5	250 V.
F3	5	250 V.
J1	S318 AB	
J2	3 CONTACT A-C PLUG	
L1	T45945	
L2	T45946	
L3	T19C36	
L4	T45952	
L5	T45946	
L6	T45952	
P1	P318 AB	
P2	9808	
R1	100M OHMS	
R2	2000 "	1 W.
R3	50 M "	1 W.
R4	100 M "	1 W.
R5	4.3 "	
R6	4.3 "	
R7	50 "	1 W.
R8	50 "	1 W.
R9	50 "	1 W.
R10	50 "	1 W.
R11	200 "	3 W.
R12	50 "	1 W.
R13	50 "	1 W.
R14	10 M "	200 W
R15	250 "	10 W.
R16	5 M "	200 W.
R17	50 M "	50 W
R18	25. "	25 W.
R19	5 M "	20 W.
R20	100 M "	20 W

Figure 44. Modulators types 50A and 50A3, schematic diagram.

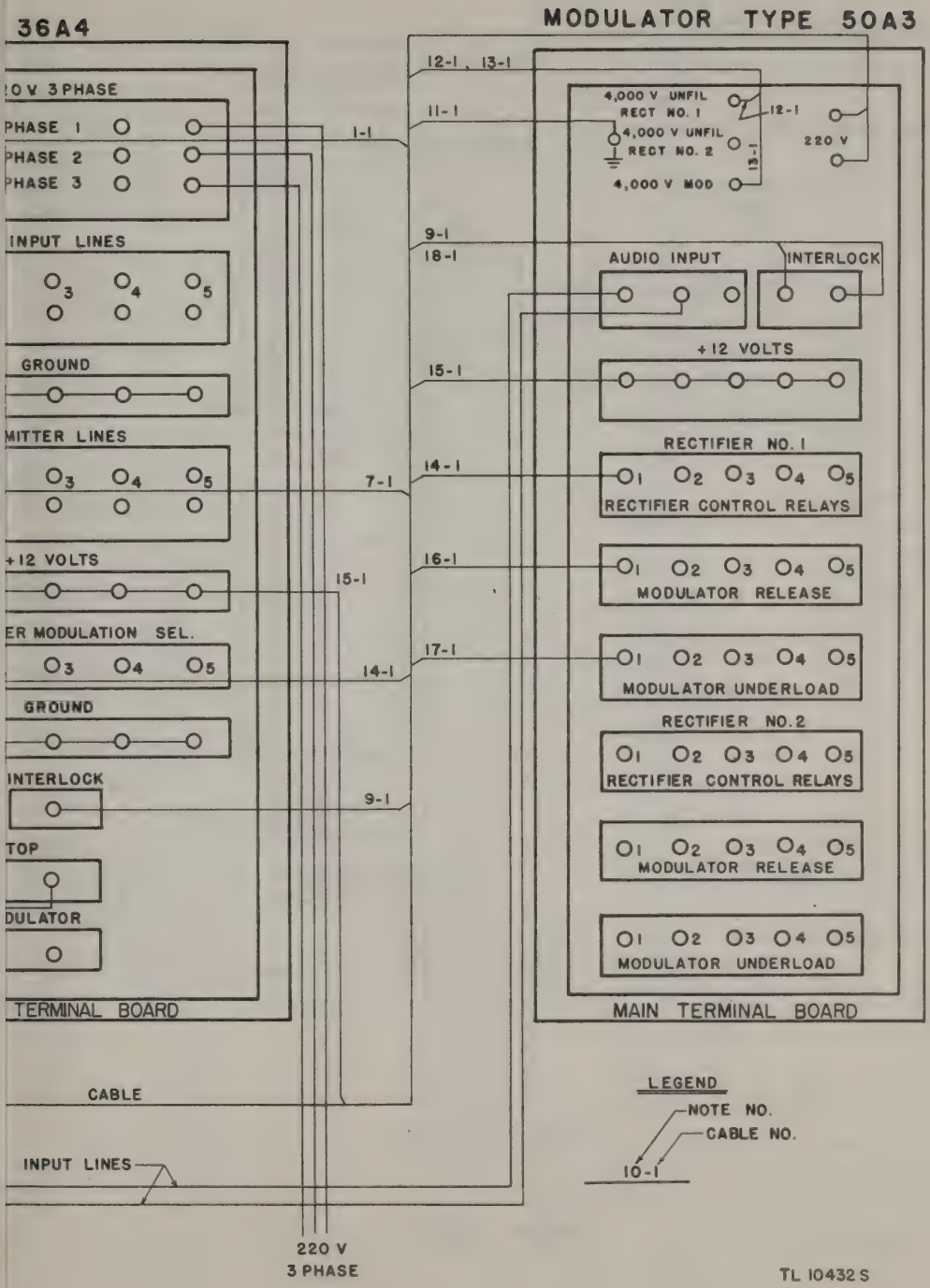
TL14586S



PARTS LIST		
NO.	VALUE	
	50A-10 MODULATOR	
R21	50 M OHMS	1W.
R22	50 "	1W.
T1	P202	
T2	T45901	
T3	T45947	
T4	S10766	
T5	T45944	
T6	T45943	
T7	T40605-A	
V1	JAN-6J5	
V2	JAN-6F6	
V3	JAN-6F6	
V4	JAN-6L6	
V5	JAN-6L6	
V6	JAN-6L6	
V7	JAN-6L6	
V8	JAN-450TL	
V9	JAN-450TL	
V10	JAN-5Z3	
V11	JAN-5Z3	
V12	JAN-5Z3	
V13	JAN-5Z3	
V14	JAN-5Z3	
V15	JAN-5Z3	
CONTROL RELAY UNIT 169D		
F1	1 AMP	
J1	S333AB	
P1	P333AB	
S1	29696	
S2	E12649	
S3	1024	
S4	1015	
S5	1601SMX	
S6	1601SMX	
T1	T26	
T2	T102	
DIALING UNIT 168C		
C1	25MF	25V
C2	1MF	1000V
D1	S-80605-8A	
J1	S310AB	
J2	S333AB	
P1	P310AB	
P2	P333AB	
R1	100 OHM	1W
S1	223C34	
S2	B12649	
S3	Z9246	
S4	D12649	
S5	1601	
S6	1601	
S7	1601	
S8	1601	
S9	1601	
S10	1601	
S11	1601	
S12	1601	
S13	1601	
S14	1601	

PARTS LIST		
NO.	VALUE	
	50A3 GENERAL	
C1	2MF	6000V.
F1	6AMP.	
F2	6 "	
F3	3 "	
F4	3 "	
L1	10764	
M1	0-750V. D-C	
M2	0-1 AMP. D-C	
M3	0-25-250-500MA D-C	
M4	DB METER -10 TO +6 DB	
N1	BLOWER 120A	
R1	750M OHMS	
R2	400M "	
S1	1325L	
S2	3592	
S3	3592	
S4	3592	
S5	Z5096	
T1	S10768	
T2	S10765	
50A-10 MODULATOR		
C1	25 MF	25V.
C2	0.25MF	600V.
C3	0.01 "	1 600V.
C4	0.01 "	1 600V.
C5	20 "	150V.
C6	20 "	150V.
C7	4 "	600V.
C8	4 "	600V.
C9	4 "	600V.
C10	4 "	600V.
C11	4 "	600V.
C12	4 "	600V.
C13	4 "	600V.
C14	4 "	600V.
C15	0.01 "	1 600V.
C16	0.01 "	1600V.
F1	5 AMP.	250V.
F2	5	250V.
F3	5	250V.
J1	S316AB	
J2	3 CONTACT A-C PLUG	
L1	T45945	
L2	T45946	
L3	T19C36	
L4	T45952	
L5	T45946	
L6	T45952	
P1	P316AB	
P2	9808	
R1	100M OHMS	
R2	2000 "	1W.
R3	50M "	1W.
R4	100M "	1W.
R5	4.3 "	
R6	4.3 "	
R7	50 "	1W
R8	50 "	1W.
R9	50 "	1W
R10	50 "	1W
R11	200 "	3W
R12	50 "	1W.
R13	50 "	1W
R14	10M "	200W
R15	250 "	10W
R16	5M "	200W
R17	50M "	50W
R18	25 "	25W
R19	5M "	20W
R20	100M "	20W

Figure 44. Modulators types 50A and 50A3, schematic diagram.


36A4
MODULATOR TYPE 50A3
12-1 , 13-1
11-1
1-1
9-1
18-1
15-1
7-1
14-1
16-1
17-1
4,000 V UNFIL RECT NO. 1
4,000 V UNFIL RECT NO. 2
4,000 V MOD
12-1
13-1
220 V
AUDIO INPUT
INTERLOCK
+12 VOLTS
RECTIFIER NO. 1
RECTIFIER CONTROL RELAYS
MODULATOR RELEASE
MODULATOR UNDERLOAD
RECTIFIER NO. 2
RECTIFIER CONTROL RELAYS
MODULATOR RELEASE
MODULATOR UNDERLOAD
MAIN TERMINAL BOARD
0 V 3 PHASE
PHASE 1
PHASE 2
PHASE 3
INPUT LINES
GROUND
MITTER LINES
+12 VOLTS
ER MODULATION SEL.
GROUND
INTERLOCK
TOP
DULATOR
TERMINAL BOARD
CABLE
INPUT LINES
220 V
3 PHASE
LEGEND
NOTE NO.
CABLE NO.
10-1

TL 10432 S

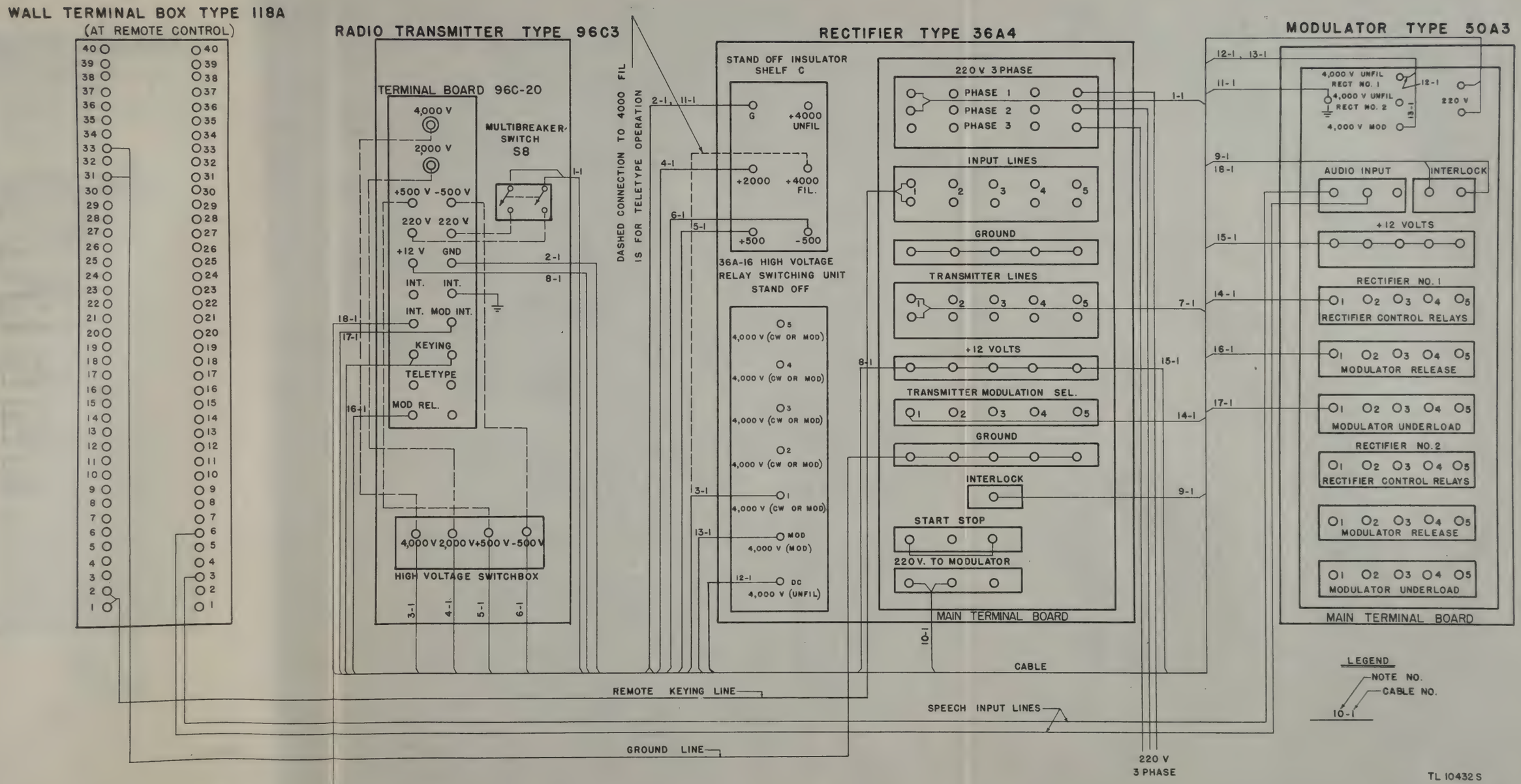
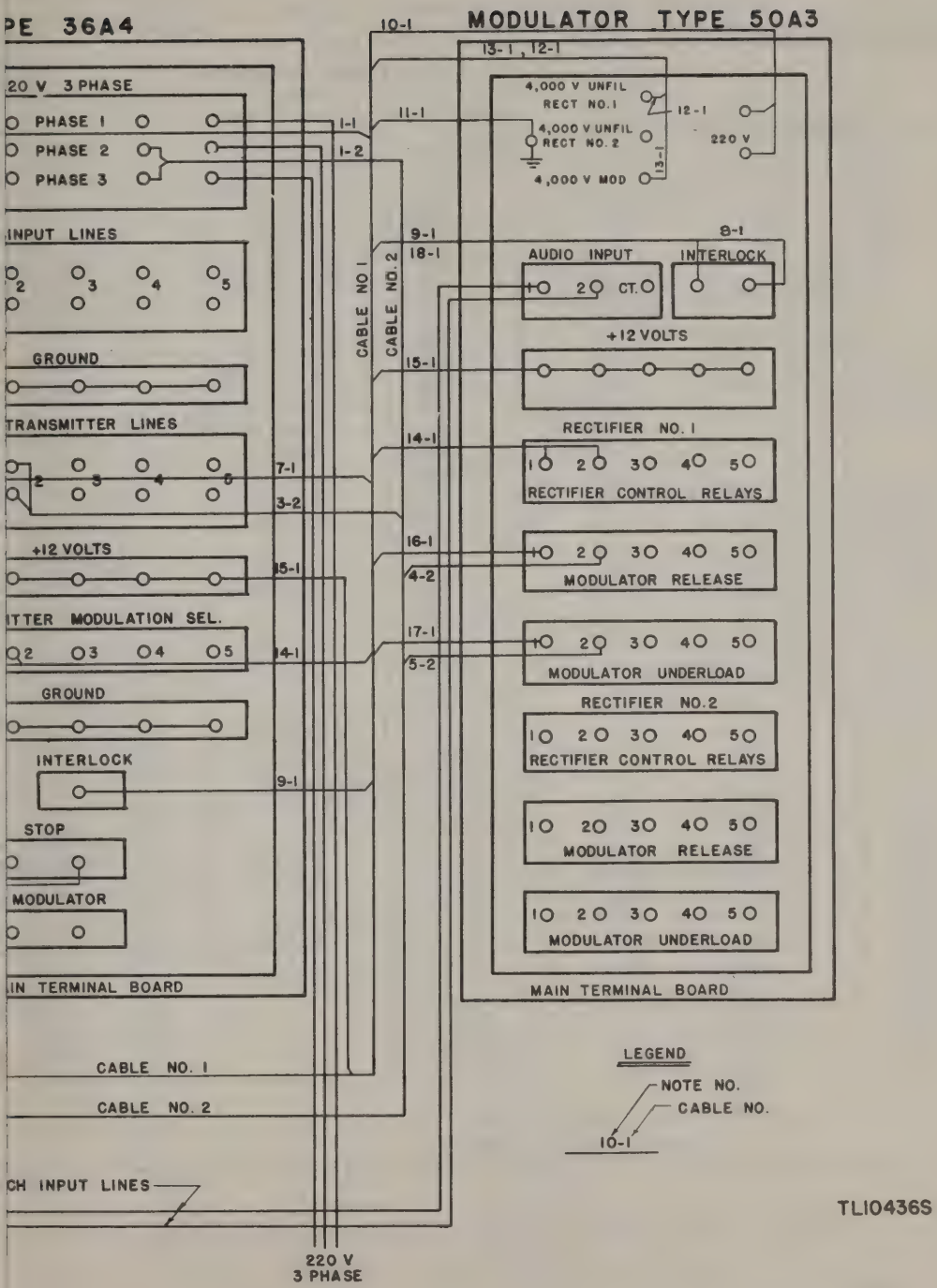
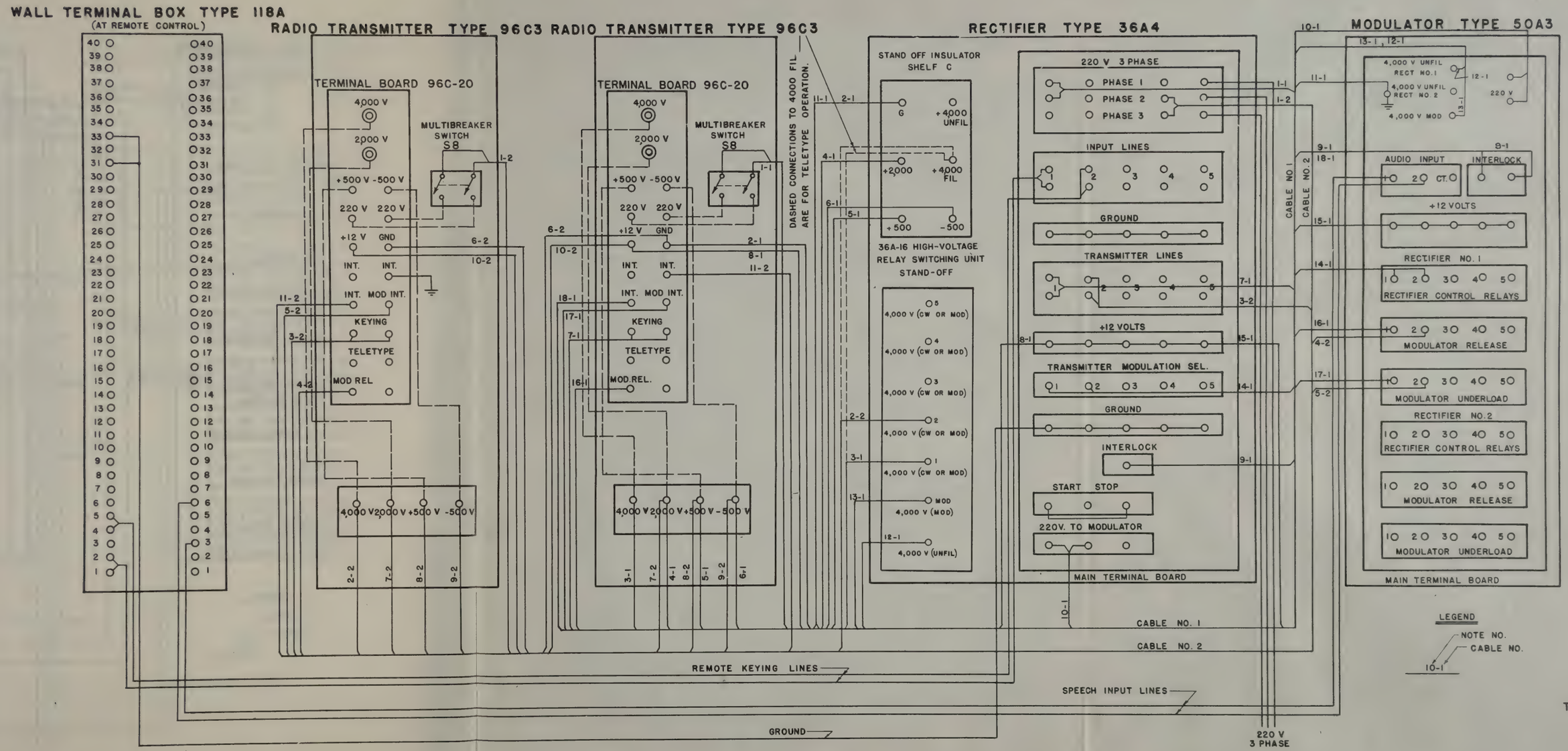


Figure 45. One radio transmitter type 96C3, one rectifier type 36A4, and one modulator type 50A3; interconnection diagram.

WALL TERMINAL BOX TYPE 119A

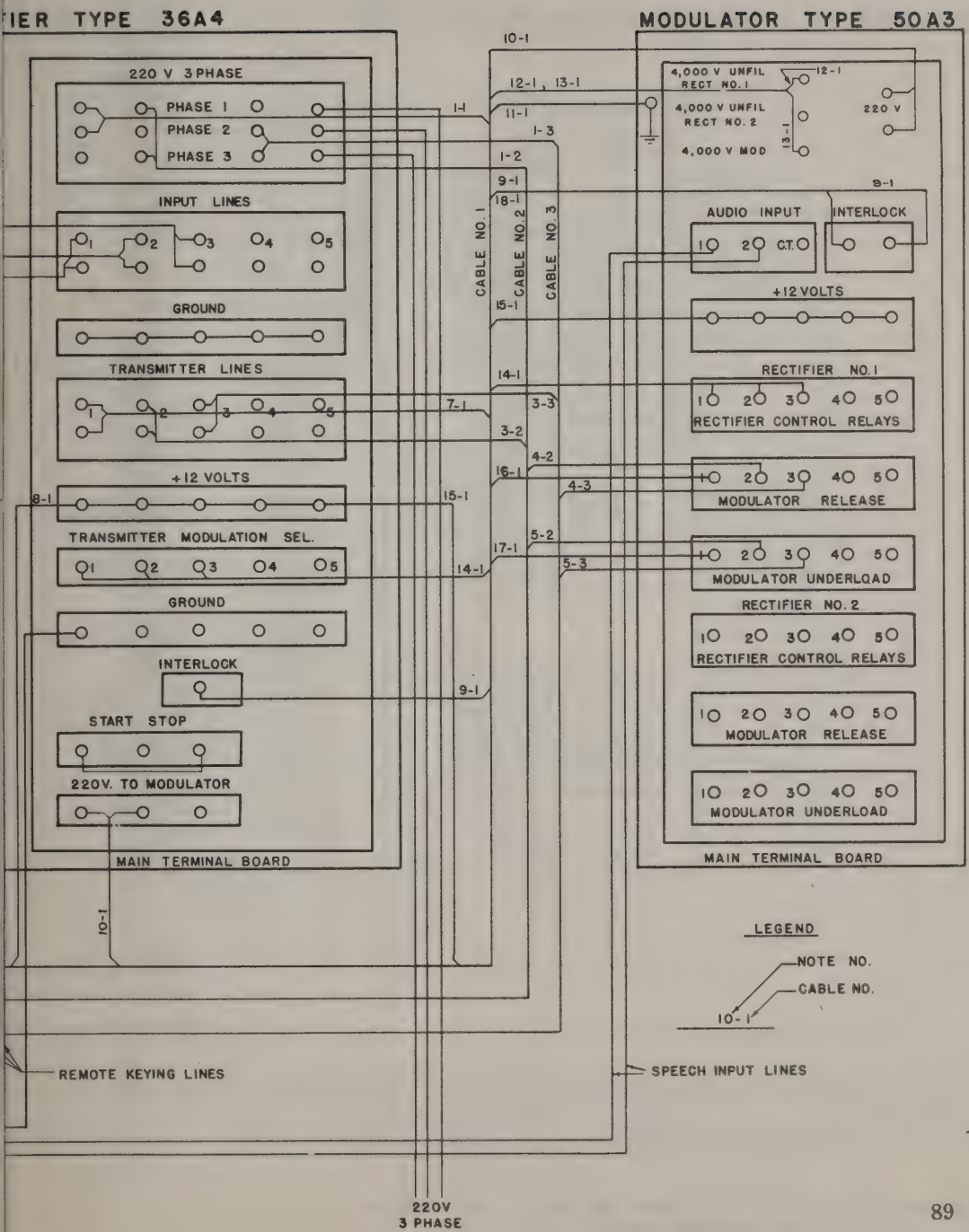

PE 36A4
MODULATOR TYPE 50A3
10-1
13-1 , 12-1
20 V 3 PHASE
PHASE 1
PHASE 2
PHASE 3
1-1
1-2
11-1
4,000 V UNFIL RECT NO.1
4,000 V UNFIL RECT NO. 2
4,000 V MOD
12-1
220 V
13-1
INPUT LINES
2
3
4
5
9-1
18-1
8-1
AUDIO INPUT
CT.
INTERLOCK
CABLE NO. 1
CABLE NO. 2
GROUND
+12 VOLTS
15-1
TRANSMITTER LINES
7-1
3-2
14-1
RECTIFIER NO. 1
1 2 3 4 5
RECTIFIER CONTROL RELAYS
16-1
4-2
MODULATOR RELEASE
+12 VOLTS
15-1
ITTER MODULATION SEL.
17-1
5-2
MODULATOR UNDERLOAD
GROUND
RECTIFIER NO.2
INTERLOCK
9-1
STOP
MODULATOR
IN TERMINAL BOARD
MAIN TERMINAL BOARD
CABLE NO. 1
CABLE NO. 2
CH INPUT LINES
220 V
3 PHASE
LEGEND
NOTE NO.
CABLE NO.
10-1

TL10436S

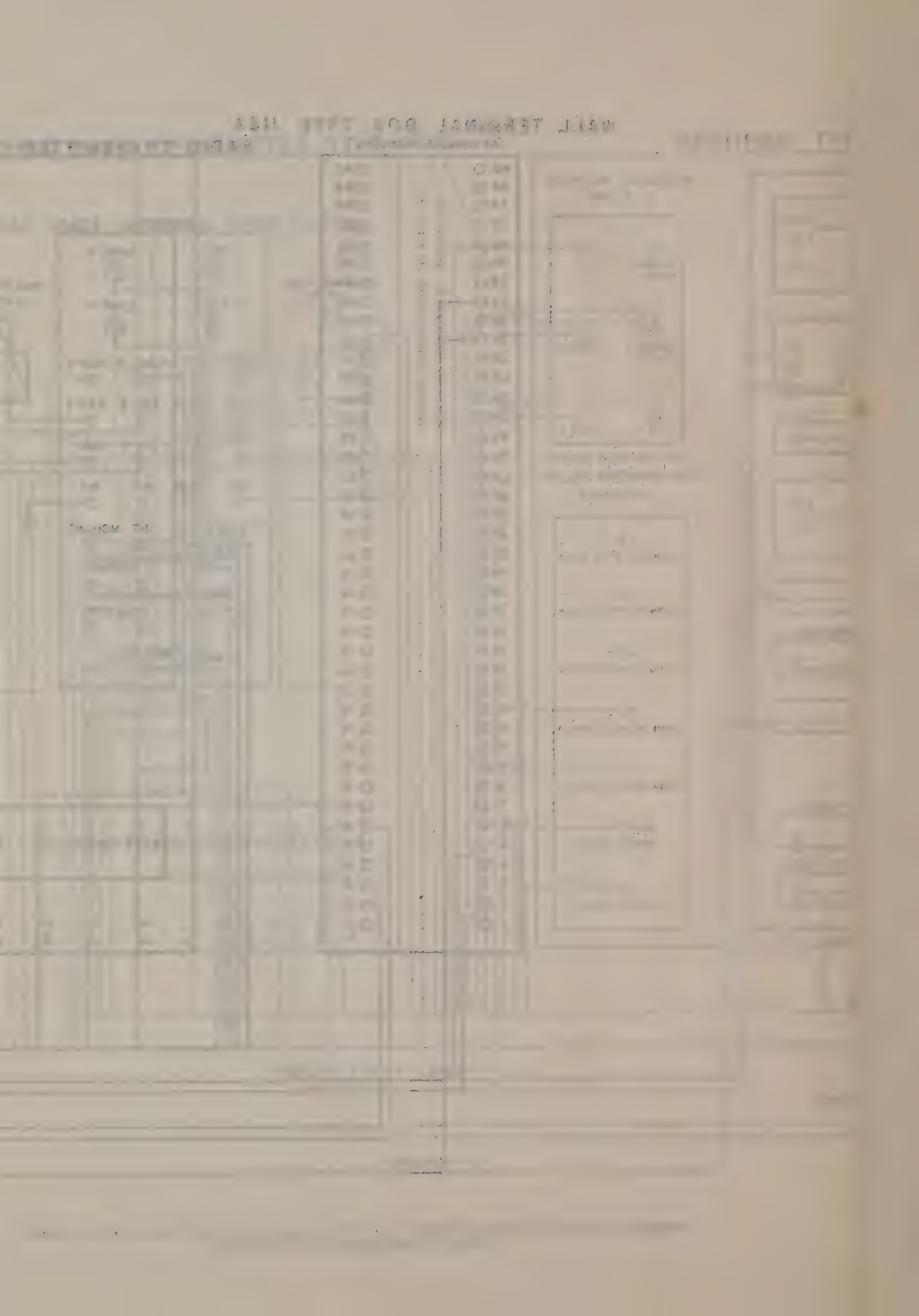


TL10436S

Figure 46. Two radio transmitters type 96C3, one rectifier type 36A4, and one modulator type 50A3; interconnection diagram.


IER TYPE 36A4
MODULATOR TYPE 50A3
220 V 3 PHASE
PHASE 1
PHASE 2
PHASE 3
INPUT LINES
GROUND
TRANSMITTER LINES
+12 VOLTS
TRANSMITTER MODULATION SEL.
GROUND
INTERLOCK
START STOP
220V. TO MODULATOR
MAIN TERMINAL BOARD
CABLE NO. 1
CABLE NO. 2
CABLE NO. 3
4,000 V UNFIL RECT NO. 1
4,000 V UNFIL RECT NO. 2
4,000 V MOD
220 V
AUDIO INPUT
INTERLOCK
+12 VOLTS
RECTIFIER NO. 1
RECTIFIER CONTROL RELAYS
MODULATOR RELEASE
MODULATOR UNDERLOAD
RECTIFIER NO. 2
RECTIFIER CONTROL RELAYS
MODULATOR RELEASE
MODULATOR UNDERLOAD
MAIN TERMINAL BOARD
LEGEND
NOTE NO.
CABLE NO.
10-1
REMOTE KEYING LINES
SPEECH INPUT LINES
220V 3 PHASE

TL10444S



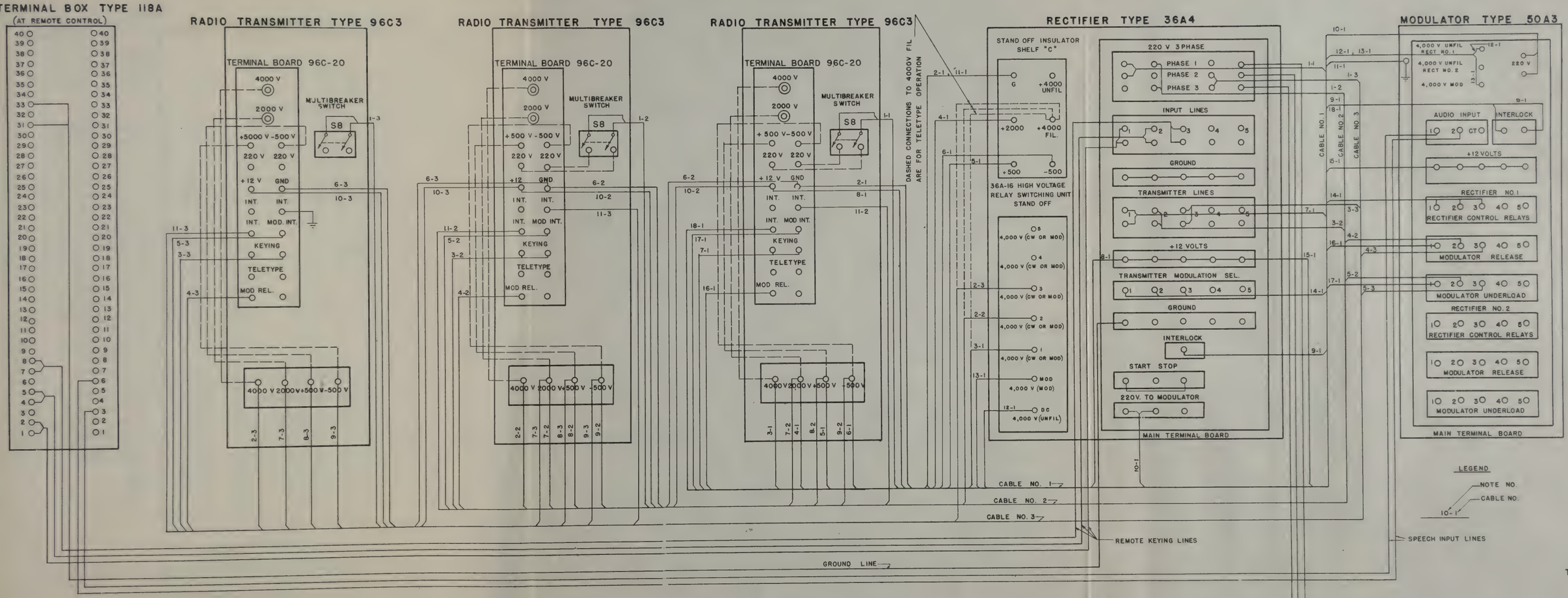


Figure 47. Three radio transmitters type 96C3, one rectifier type 36A4, and one modulator type 50A3; interconnection diagram.

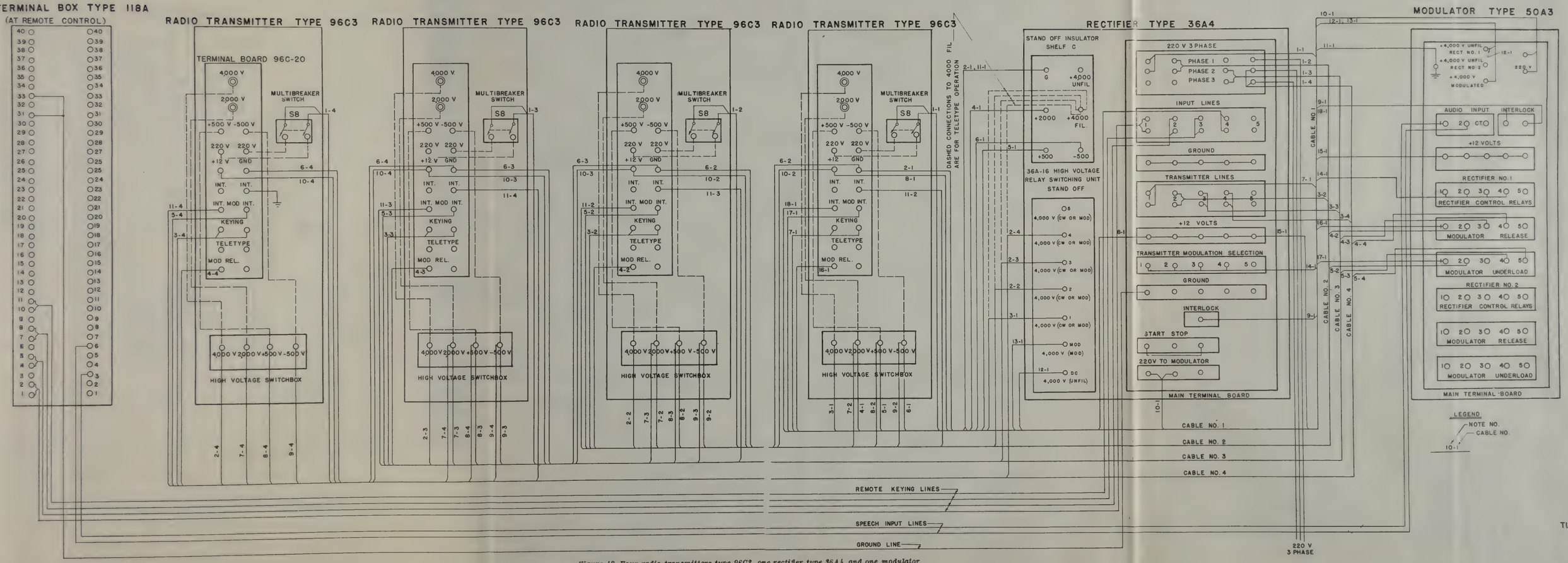
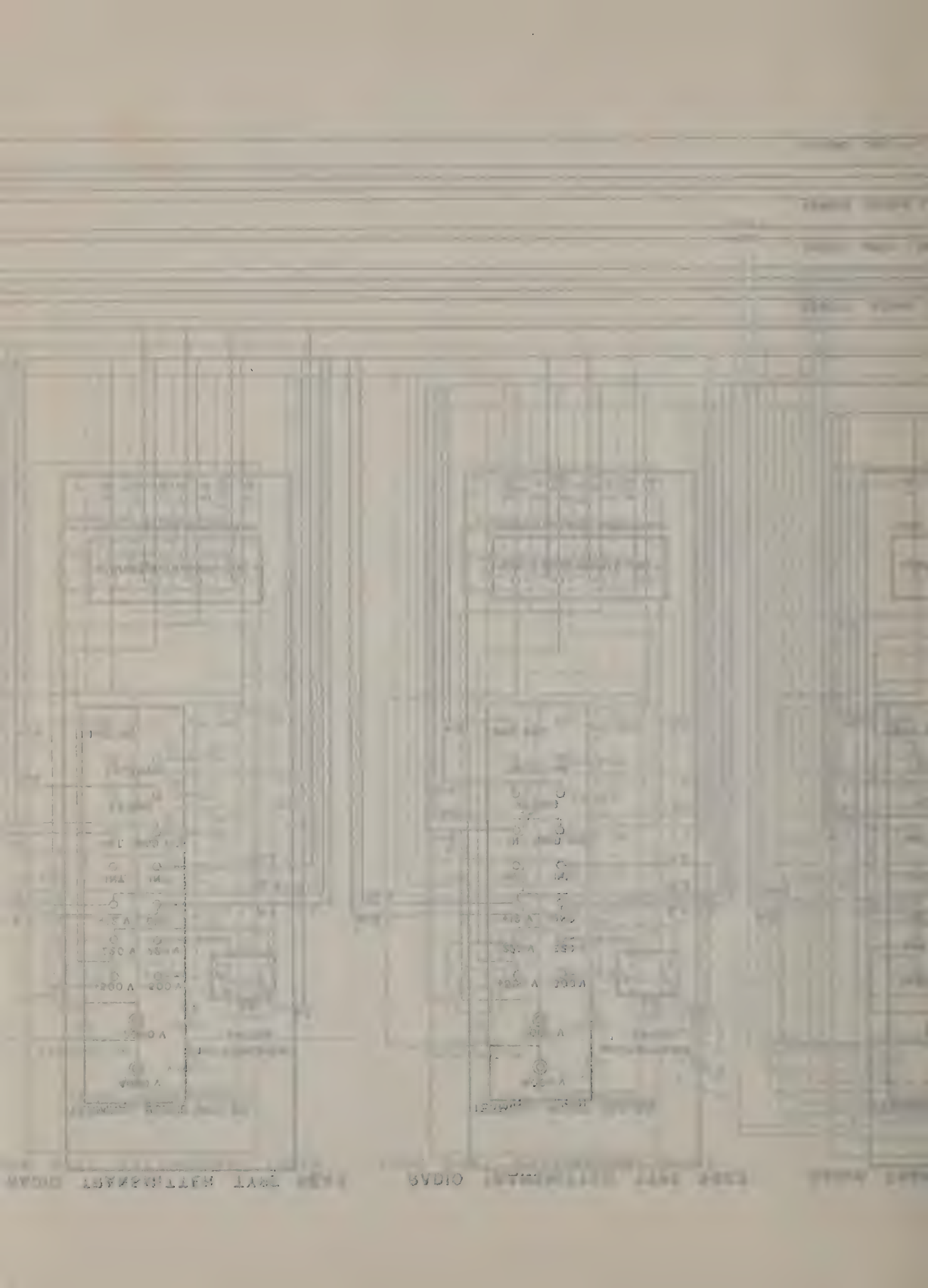


Figure 48. Four radio transmitters type 96C3, one rectifier type 36A4, and one modulator type 50A3; interconnection diagram.



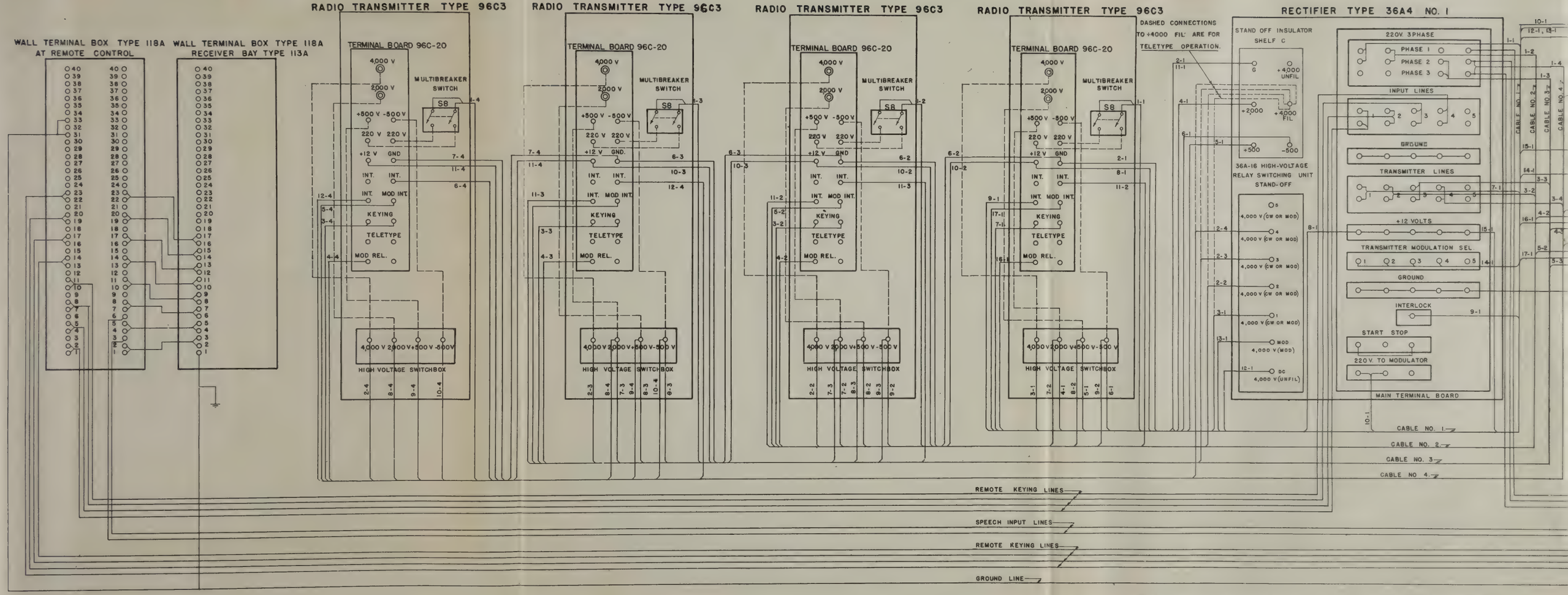
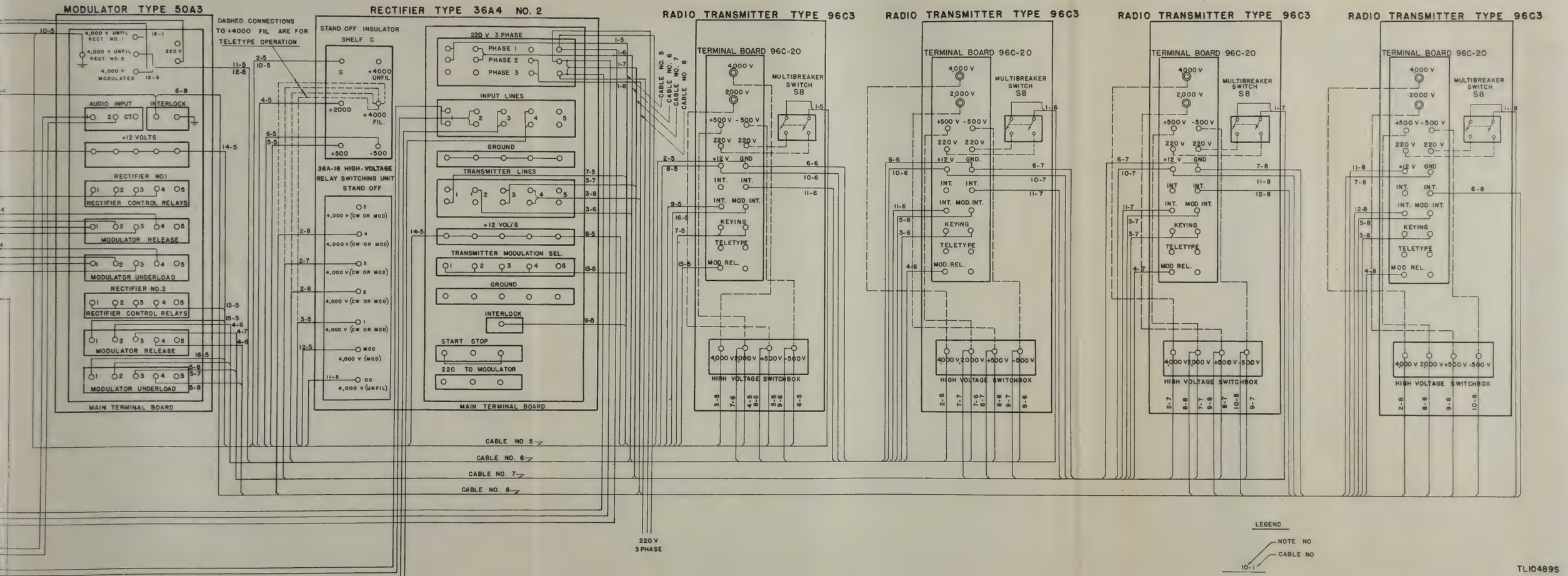


Figure 49. Eight radio transmitters type 96C3, two rectifiers type 36A4, and one modulator type 50A3; interconnection diagram.


MODULATOR TYPE 50A3
4,000 V UNFIL RECT NO. 1
4,000 V UNFIL RECT NO. 2
4,000 V MODULATED
220 V
AUDIO INPUT
INTERLOCK
2 CT
+12 VOLTS
RECTIFIER NO. 1
RECTIFIER CONTROL RELAYS
MODULATOR RELEASE
MODULATOR UNDERLOAD
RECTIFIER NO. 2
RECTIFIER CONTROL RELAYS
MODULATOR RELEASE
MODULATOR UNDERLOAD
MAIN TERMINAL BOARD
DASHED CONNECTIONS TO +4000 FIL ARE FOR TELETYPE OPERATION
RECTIFIER TYPE 36A4 NO. 2
STAND OFF INSULATOR SHELF C
G
+4000 UNFIL
+2000
+4000 FIL.
+500
-500
36A-16 HIGH-VOLTAGE RELAY SWITCHING UNIT STAND OFF
4,000 V (CW OR MOD)
4,000 V (CW OR MOD)
4,000 V (CW OR MOD)
4,000 V (CW OR MOD)
4,000 V (CW OR MOD)
MOD 4,000 V (MOD)
DC 4,000 V (UNFIL)
220 V 3 PHASE
PHASE 1
PHASE 2
PHASE 3
INPUT LINES
GROUND
TRANSMITTER LINES
+12 VOLTS
TRANSMITTER MODULATION SEL.
GROUND
INTERLOCK
START STOP
220 TO MODULATOR
MAIN TERMINAL BOARD
CABLE NO. 5
CABLE NO. 6
CABLE NO. 7
CABLE NO. 8
220 V 3 PHASE
RADIO TRANSMITTER TYPE 96C3
TERMINAL BOARD 96C-20
4000 V
2000 V
+500 V -500 V
220 V 220 V
+12 V GND
INT. INT.
INT. MOD INT.
KEYING
TELETYPE
MOD. REL.
MULTIBREAKER SWITCH S8
4000 V 2000 V +500 V -500 V
HIGH VOLTAGE SWITCHBOX
RADIO TRANSMITTER TYPE 96C3
TERMINAL BOARD 96C-20
RADIO TRANSMITTER TYPE 96C3
TERMINAL BOARD 96C-20
RADIO TRANSMITTER TYPE 96C3
TERMINAL BOARD 96C-20
LEGEND
NOTE NO
CABLE NO
10-1

TL10489S

TM 11-2650-2 SIGNAL CORPS 14 FEB 57

PUBLICATION MODULATOR MDL: MD-69/FRT OPERATION MANUAL
DTD 19 NOV 1945

CHARGE OUT RECORD CARD

DATE ISSUED	SIGNATURE OF RECIPIENT	DIVISION SECTION OR OFFICE	DATE RETURNED

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DATE ISSUED	SIGNATURE OF RECIPIENT	DIVISION SECTION OR OFFICE	DATE RETURNED

EMC 330 (1 NOV 54)

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